# APPENDIX B
# AVIATION ACTIVITY FORECASTS

## B.1 PURPOSE

The purpose of this appendix is to determine if the City of Chicago's (City) Aviation Forecasts appropriately represent the level of aircraft activity likely to occur at O'Hare International Airport (O'Hare or the airport) during the forecast period. Consideration is given to whether the forecast conditions are reasonable given historical data and the outlook for the future.

## B.2 INTRODUCTION AND BACKGROUND

The Chicago Department of Aviation (CDA) submitted, to the Federal Aviation Administration (FAA) and the FAA Third Party Consultant, documentation with its annual activity and design day forecasts for enplanements and operations including passenger airlines, cargo airlines, general aviation, and military. This documentation can be found at the end of this chapter in **Attachment B-2**. The FAA and its Third Party Consultant, herein referred to as the FAA Third Party Consultant, reviewed the materials provided by the CDA on annual enplanement and operations forecast for the period ending 2030.

The CDA utilized the FAA's Terminal Area Forecast (TAF) for the annual enplanement forecast and historical schedule data, along with future fleet orders, for the annual operations forecast. Each year the FAA prepares a TAF, and the forecasts are based on industry standard analyses of Federal Fiscal Year trends in airline service and represent the FAA's official outlook for airports in the National Plan of Integrated Airport Systems (NPIAS). When this Environmental Assessment (EA) was started in 2019, the most current FAA forecast available at the time was the 2018 TAF, published in early 2019. The TAF projects operations and enplanements for fiscal years ending on September 30. The following years were selected for analysis: 2023 (peak construction year) and 2030 (Build Out).

Work on the EA process commenced in 2019. Due to extensive special purpose law analysis, the proposed construction schedule for the Proposed Action was shifted by two years. The original forecast period utilized to assess the environmental effects of the Proposed Action was 2019-30 with specific design days analyzed for the Interim Condition in 2023, representing a peak construction year, and 2030 reflecting Build Out. As a result of the revised timetable, the forecast year representing peak construction conditions analyzed in the Interim year shifts from 2023 to 2025, and Build Out shifts from 2030 to 2032. The FAA re-examined the differences in passenger operations, passenger fleet mix, and total aircraft operations from 2023 and 2030 to 2025 and 2032. The analysis in **Attachment B-1** demonstrates that differences in fleet mix and operations are not material and that there would not be significant changes to the forecast if the analysis years are shifted.

For the analysis required, these fiscal year activity levels were adjusted to full calendar years (CY). The CDA forecasts are presented in **Table B-1**.

## TABLE B-1
## CHICAGO DEPARTMENT OF AVIATION ACTIVITY FORECASTS

| | 2018 | 2023 | 2030 | CAGR: 2018-2030 |
|---|---|---|---|---|
| Enplanements (Mns) | 41.6 | 47.4 | 53.6 | 2.1% |
| **Operations** | | | | |
| Passenger | 877,461 | 918,075 | 973,592 | 0.9% |
| Cargo | 24,739 | 28,433 | 34,283 | 2.8% |
| General Aviation | 5,770 | 5,906 | 5,906 | 0.2% |
| Military | 75 | 75 | 75 | 0.0% |
| Total Operations | 908,045 | 952,489 | 1,013,856 | 0.9% |

Notes: Compound annual growth rate (CAGR); millions (Mns)
Sources: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

Additionally, the COVID-19 pandemic occurred between the time of the CDA's development of the activity forecast and the completion of this document. As a result, the FAA Third Party Consultant analyzed the impact COVID-19 might have on O'Hare's activity levels. The analysis found that COVID-19 had an immediate and significant impact on O'Hare's passenger traffic and operations, but that O'Hare would return to growth and achieve previously forecasted traffic levels for 2030 by 2032. This is consistent with the change in the EA construction schedule; therefore, the CDA forecasts remain appropriate for environmental purposes. A summary of this analysis can be found in **Appendix N.**

## B.3 SCOPE OF WORK

The FAA requested that its Third Party Consultant complete a comprehensive review of the CDA's forecasts to determine if the annual enplanement and operation levels and assumptions were appropriate and if the CDA's Design Day Flight Schedules were reasonable and appropriate for environmental modeling purposes for this EA. A key element in the review of the forecasts was whether the facilities in the Proposed Action would induce demand. The analysis included (1) a review of passenger traffic trends at O'Hare, Chicago, and the United States (U.S.) aviation industry, (2) trends in aircraft operations and fleet mix, and (3) peak month average day activity in design day flight schedules. The FAA Third Party Consultant needed to determine whether a new forecast for the EA—other than prepared by the CDA—was required.

## B.4 METHODOLOGY

To validate the use of the CDA's forecasted activity levels in the EA, the FAA's Third Party Consultant independently assessed three factors:

1. The CDA's methodology and results,
2. The underlying trends in the relevant aviation market, and,
3. The likelihood that the Proposed Action would result in induced demand.

## B.5 PASSENGER TRAFFIC ANALYSIS

The CDA utilized the FAA's 2018 TAF enplanement (passenger) forecast for O'Hare for use in the EA.1 The TAF is prepared by reviewing recent industry trends and expectations of future airline service and schedule data to inform near-term forecasts, and through statistical analysis of the relationship between historical demand and local and national economic conditions to inform longer-term forecasts. Per the FAA, the TAF assumes a demand-driven forecast for aviation services based on local and national economic conditions and conditions within the aviation industry and is developed independent of the ability of the airport and air traffic control system to provide the capacity required to meet demand.

To make the TAF useful for the EA analysis, three adjustments or assumptions were made by the CDA. Notably, the CDA:

1. Converted the TAF's enplanement projections from Federal Fiscal Years ending September 30 to Calendar Years ending December 31. The CDA utilized U.S. Department of Transportation T-100 data from the time period between December 2017 and November 2018 to make this conversion.
2. Assumed that O'Hare's Origin and Destination (O&D) and connecting passenger split remains stable throughout the forecast period. This assumption is also made by the FAA in creating the TAF.
3. Adjusted the TAF to account for non-revenue passengers, which in 2018 represented 3.2 percent of O'Hare's passengers. (The TAF only includes revenue passengers.) To reflect all the activity at O'Hare, non-revenue passengers—such as airline staff travelers—were added to the TAF based on U.S. Department of Transportation T-100 data.

The TAF and the CDA's forecast of enplanements are shown in **Attachment B-2** and in **Table B-2**.

### TABLE B-2
### CHICAGO DEPARTMENT OF AVIATION ENPLANEMENT FORECASTS

| Year | TAF (Fiscal Years) | TAF (Calendar Years) |
|---|---:|---:|
| 2007 | 36,742,947 | 36,217,744 |
| 2008 | 34,630,139 | 33,786,366 |
| 2009 | 31,235,776 | 31,412,704 |
| 2010 | 31,947,531 | 31,917,226 |
| 2011 | 31,825,619 | 31,932,654 |
| 2012 | 32,256,202 | 32,185,877 |
| 2013 | 31,973,296 | 32,342,340 |
| 2014 | 33,457,901 | 34,021,847 |
| 2015 | 35,726,566 | 36,130,416 |
| 2016 | 37,351,189 | 37,554,536 |
| 2017 | 38,169,220 | 38,568,476 |
| 2018 | 39,775,365 | 40,309,141 |
| 2019 | 41,922,662 | 42,184,491 |

[1] https://www.faa.gov/data_research/aviation/taf/

| Year | TAF (Fiscal Years) | TAF (Calendar Years) |
|---|---|---|
| 2020 | 42,975,959 | 43,211,552 |
| 2021 | 43,923,714 | 44,144,993 |
| 2022 | 44,813,884 | 45,027,930 |
| 2023 | 45,674,957 | 45,878,026 |
| 2024 | 46,491,870 | 46,694,565 |
| 2025 | 47,307,278 | 47,509,690 |
| 2026 | 48,121,550 | 48,331,092 |
| 2027 | 48,964,505 | 49,183,402 |
| 2028 | 49,845,092 | 50,072,333 |
| 2029 | 50,759,245 | 50,993,653 |
| 2030 | 51,702,230 | 51,941,815 |
| CAGR (2007-18) | 0.7% | 1.0% |
| CAGR (2018-30) | 2.2% | 2.1% |
| Sources: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020; Federal Aviation Administration 2018 Terminal Area Forecast | | |

### B.5.1 Review of the CDA Analysis Completed in Support of Utilizing the 2018 TAF

The CDA prepared two analyses to assess the reasonableness of using the 2018 TAF for O'Hare for the annual enplanement forecast. These analyses are:

1. Regression analyses of O'Hare's total enplanements, using both local and national economic and demographic data as independent variables, and forecasting enplanements in future years using the generally accepted sources of economic forecasts and the historical relationship between those variables and enplanements.
2. Review of O'Hare's historical share of U.S. Revenue Enplaned Passengers, generating a forecast of enplaned passengers at O'Hare should its share of the U.S. total remain at 4.5 percent over the forecast period.

Both analyses' growth rates were in line with the 2018 TAF Compound Annual Growth Rate (CAGR) of 2.1 percent from 2018 to 2030.

#### B.5.1.1 CDA Regression Analysis

The CDA conducted a regression analysis that examined the relationship between historical total passengers and local and national economic and demographic data. The CDA used single variable regression analysis to analyze the relationships between passenger volumes and the economic and demographic data. The economic and demographic variables included earnings, employment, gross regional product, population, personal income, and personal income per capita for the Chicago Combined Statistical Area and the U.S. This analysis was used to forecast enplaned passenger volumes over the forecast period from 2019 through 2030.

The CDA presented to the FAA the coefficient of determination, commonly referred to as the r-squared value, and the CAGR associated with each regression. The R-Squared Values all indicated that the independent socio-economic variables explained approximately 90 percent or more of the variation in the dependent aviation activity variable and as such were acceptable on econometric and statistical bases.

The forecasted growth rates using regression analysis generated similar results to the TAF growth rate of 2.1 percent. This led the CDA to conclude that the 2018 TAF growth rates were appropriate to use for the enplaned passenger forecast.

#### B.5.1.2 CDA Market Share Analysis

The second method that the CDA used to assess the reasonableness of the TAF was to conduct a market share analysis of O'Hare's revenue enplaned passengers compared to the United States. This analysis used the FAA's national forecast for U.S. revenue enplaned passengers and the 2018 TAF for O'Hare. Based on O'Hare's historic share of the U.S. revenue enplaned passengers (4.5 percent), the CDA forecasted O'Hare's enplaned passenger volumes through 2030. This method produced a 2.1 percent growth rate for O'Hare, same as for the TAF.

#### B.5.1.3 Conclusion of the CDA's Analysis and Further Information Required by FAA

Overall, both the regression analysis and the market share analysis produced results that support the utilization of the TAF's enplaned passenger forecast for O'Hare. The CDA's annual forecast for enplaned passengers is shown in **Table B-3**. With a CAGR of 2.1 percent through 2030, O'Hare's enplaned passengers are forecast to increase from 41.6 million in 2018 to 53.6 million in 2030.

## TABLE B-3
## CHICAGO DEPARTMENT OF AVIATION ENPLANEMENT FORECASTS

| Year | Total Enplaned Passengers |
|---|---|
| 2018 | 41,623,010 |
| 2019 | 43,560,290 |
| 2020 | 44,620,281 |
| 2021 | 45,583,343 |
| 2022 | 46,494,099 |
| 2023 | 47,370,842 |
| 2024 | 48,212,837 |
| 2025 | 49,053,364 |
| 2026 | 49,900,388 |
| 2027 | 50,779,408 |
| 2028 | 51,696,340 |
| 2029 | 52,646,798 |
| 2030 | 53,625,042 |
| CAGR (2018-30) | 2.1% |

Sources: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

To further validate the appropriateness of the TAF, the FAA and its Third Party Consultant requested information on O'Hare's historic response to the easing of constraints, either by easing schedule limits or through increased gate availability. The Proposed Action would increase linear gate frontage by 14.2 percent. If the airport were currently constrained and unable to accommodate new carriers and/or

additional service, there would be pent-up demand. This pent-up demand could be relieved when the new facilities become available. This pent-up demand is also known as latent demand. If that were the case, the airport could experience growth due to "induced demand."

In response to the FAA's request, the CDA report assessed the concept of induced demand. The CDA analyzed the current utilization of gates at O'Hare by reviewing the current flight schedule and finding that the current gates at O'Hare are not utilized as intensively as they could be. In essence, the CDA found that existing gates could accommodate more flights per day or larger aircraft, in alignment with normal airline practices to not schedule more than 8 to 10 turns per gate per daily.[2,3,4] Therefore, the CDA concluded that with no pent-up demand at present, there is no likelihood of induced demand in the future. The FAA's Third Party Consultant conducted an independent analysis that examined actual trends with easing of capacity constraints and reached the same conclusion regarding historic factors. The independent analysis is presented in the following section.

### B.5.2 FAA Third Party Consultant Analysis of Historical Data to Understand Whether O'Hare Exhibits Indicators of Induced Demand

Because O'Hare has been subject to activity limitations in the past, this analysis assesses whether there is evidence that pent-up demand growth occurred after the capacity limitations were eased or if facility constraints resulted in curbing of traffic growth.

The FAA's Third Party Consultant analyzed a series of factors that required deeper analysis. Specific emphasis was placed on examining O'Hare's carriers' seat capacity responses after relief from capacity constraints either through new runway capacity (and subsequent easing of FAA schedule limits) or the addition of gates. This has occurred three times in O'Hare's recent past.

1. In 2004, the FAA enforced a previously voluntary restriction on the number of aircraft operations that O'Hare could accommodate. This was done in response to excessive delays caused by insufficient runway capacity. This schedule limit was lifted in 2008 after new Runway 9L/27R opened and the capacity of the airfield increased.
2. The second easing of facility capacity constraints resulted from remedies required by the U.S. Departments of Justice and Transportation to approve the merger of American Airlines and US Airways in December 2013. This merger resulted in American Airlines ("American") making gates available to other airlines.
3. The third occurrence was in 2018, when five new gates opened for American in the Concourse L-Stinger.

To complete this analysis, the FAA's Third Party Consultant reviewed the following criteria:

- Passenger development in comparison to other large U.S. airports,
- Outbound passenger development in relation to local economic and demographic development,
- Inbound passenger development in comparison to other large U.S. airports,
- Non-stop international seat capacity in comparison to other large U.S. airports,
- Low-cost and ultra-low-cost carrier seat capacity and market share versus the U.S. average,
- The impact of gate reallocation at O'Hare following airline mergers: American/US Airways, Delta Air Lines/Northwest Airlines, and United Airlines ("United")/Continental Airlines,

[2] See ACRP Report 163, Guidebook for Preparing and Using Airport Design Day Flight Schedules, page 60
[3] As noted in Attachment B-1, the results of TAAM modeling of activity levels in 2023 and 2030 did not trigger delays under a no-action scenario and all flights could be gated.
[4] See Attachment B-2 for all gate schedules for No Action and Proposed Action conditions analyzed.

- Origin & Destination (O-D) versus Connecting Passenger trends at O'Hare on American and United Airlines,
- The impact of the removal of FAA orders Limiting Scheduled Operations at O'Hare[5] in 2008[6] following the opening of Runway 9L/27R,[7]
- The impact of airline schedule rebanking[8] versus de-peaking on passenger traffic,
- The impact of Global Alliances on airline seat capacity and traffic at O'Hare, and
- The impact of the new L-stinger gates on traffic and seat capacity at O'Hare.

Evidence of pent-up demand is defined as a broad-based increase in activity unleashed by facilities being made available that would result in a sustained change in activity at O'Hare. There were increases in year-to-year growth related to international carrier activity in 2014 and Ultra Low Cost Carrier activity in 2015. However, the multi-year growth rate from 2007 to 2018 indicated no change in activity trends. Over this period, O'Hare experienced slower growth than other Large Hubs and the industry. Therefore, no evidence exists of pent-up demand at O'Hare.

#### B.5.2.1 Does passenger growth at O'Hare suggest a level of induced demand due to the easing of schedule limits or gate transfers due to carrier consolidation?

**Table B-4** presents a comparison of O'Hare's enplaned passenger history for the 2007–18 period to that of all Large Hubs and the U.S. industry. Total enplaned passengers at O'Hare increased at a CAGR of 0.7 percent for the 11-year period. This rate is less than half of other Large Hub airports. For O'Hare, this marks a period when the new Runway 9L/27R opened and in 2008 slot restrictions were lifted by the FAA. Despite the newly available runway capacity, the period started with a steep decline due to a weak economy during the Great Recession of 2008 and 2009. This was followed by a four-year period of stagnation, where O'Hare's enplaned passengers remained 12 percent below its 2007 level and lagged the growth experienced in the broader airline industry. For the six-year period following the removal of slots at O'Hare, there was no evidence of pent-up demand being stimulated by the removal of slots. As discussed earlier, a series of econometric regressions conducted by the CDA's consultants that compared the growth in passenger traffic to both the Chicago and national economy found that the economy explained more than 90 percent of O'Hare's passenger traffic growth trends.

From 2013 to 2018, O'Hare outgrew other large hubs and the airline industry as shown in **Table B-4**. In 2014, gates historically used by the hub carriers were made available to Low Cost Carriers (LCCs) as a result of major carrier consolidation. Initially, O'Hare's growth accelerated. However, compared to large hubs and the industry, O'Hare's annual growth rate was only faster in 2014 and 2015 then lagged behind annual growth rates for the industry and large hubs in 2016.

[5] FAA Orders limiting scheduling at O'Hare were adopted on January 21, 2004, April 21, 2004, and August 18, 2004.

[6] The High Density Rule (or "Slot" rule) is a federal regulation established in 1969 (14 CFR Section 93.123) to manage congestion at five high-density airports: Ronald Reagan Washington National Airport, New York City's John F. Kennedy International, LaGuardia, Newark Liberty International airports, and Chicago's O'Hare International Airport (ORD). A slot is an Instrument Flight Rules (IFR) reservation for an arrival or a departure. A "slot pair" is equivalent to a round trip flight. O'Hare was subject to slot controls until 1999, when the slot control system was phased out through 2004. Schedule limits were reimposed for a temporary period while additional runways were built as a part of the O'Hare Modernization Plan, but have been removed since 2008. O'Hare remains a Worldwide Airport Slot Guidelines (WASG) Level II airport for schedule facilitation under FAA Schedule Orders.

[7] Due to significant delays following the phasing out of the High Density Rule in 2002, the FAA imposed schedule limits on O'Hare starting in 2004. The schedule limits expired when new Runway 9L/27R opened in 2008.

[8] Re-banking a hub means that a carrier intends to move its schedule back to a defined connecting bank hub in which large numbers of flights arrive during a short time period, remain on the ground for approximately an hour, then depart in large numbers during a short time period. The benefit of the defined connecting bank hub is that it maximizes revenue by providing connections between a large number of origin and destination points in a short period of time, but it is expensive to operate because it requires large amounts of space, equipment, and employees while planes are on the ground during a bank that stands empty or idle between banks.

Finally, despite the addition of five gates in Spring of 2018, O'Hare's growth in 2018 was lower than that of Large Hubs and the industry as a whole. Hence, analysis of total growth at O'Hare compared to other large hubs and the aggregate airline industry indicates growth rates broadly consistent with the economy and industry trends. Comparable growth at O'Hare and the industry does not support that new runway capacity or additional gates at O'Hare resulted in the release of pent-up demand.

## TABLE B-4
## TOTAL ENPLANEMENTS AT O'HARE, LARGE HUB AIRPORTS, AND THE U.S. INDUSTRY (MILLIONS, CY 2007-18)

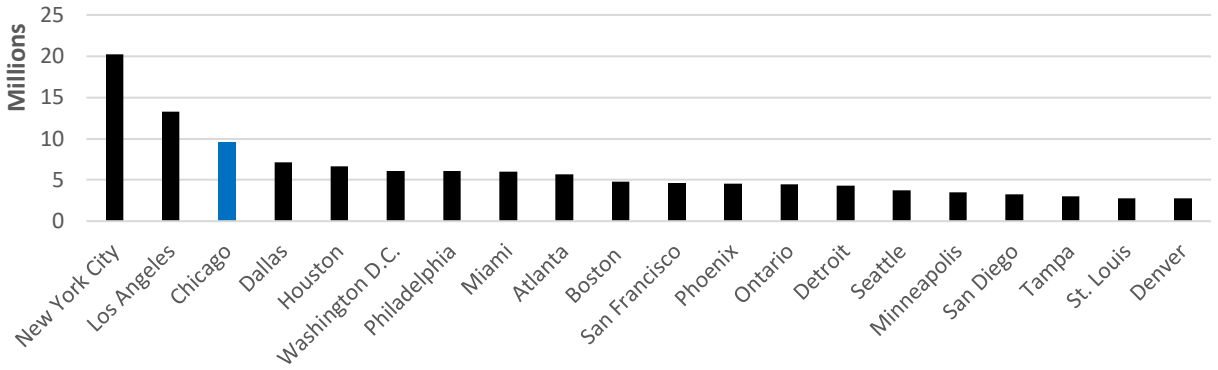
| | Enplanements | | | Percent Change | | |
|---|---|---|---|---|---|---|
| Year | O'Hare | Large Hub Airports | U.S. Airline Industry | O'Hare | Large Hub Airports | U.S. Airline Industry |
| 2007 | 36.7 | 529.9 | 769.8 | | | |
| 2008 | 33.8 | 515.0 | 741.8 | -7.9% | -2.8% | -3.6% |
| 2009 | 31.3 | 495.0 | 702.9 | -7.5% | -3.9% | -5.3% |
| 2010 | 32.3 | 507.7 | 717.8 | 3.4% | 2.6% | 2.1% |
| 2011 | 32.1 | 519.0 | 729.9 | -0.7% | 2.2% | 1.7% |
| 2012 | 32.2 | 526.5 | 734.8 | 0.3% | 1.5% | 0.7% |
| 2013 | 32.3 | 534.7 | 741.6 | 0.4% | 1.6% | 0.9% |
| 2014 | 33.6 | 551.6 | 762.0 | 4.1% | 3.2% | 2.8% |
| 2015 | 36.2 | 581.2 | 799.0 | 7.6% | 5.4% | 4.9% |
| 2016 | 37.4 | 601.1 | 827.6 | 3.3% | 3.4% | 3.6% |
| 2017 | 38.4 | 617.5 | 855.6 | 2.8% | 2.7% | 3.4% |
| 2018 | 39.7 | 640.9 | 896.1 | 3.4% | 3.8% | 4.7% |
| ***CAGR*** | | | | | | |
| *2007-18* | *0.7%* | *1.7%* | *1.4%* | | | |
| *2013-18* | *4.2%* | *3.7%* | *3.9%* | | | |

Sources: US DOT T-100 Database, Large Hub Based on 2017 Enplanement Data from the FAA

#### B.5.2.2 Is O'Hare's passenger traffic generation consistent with the Chicago Metropolitan Statistical Area's (MSA) population and income, or does it appear to be constrained due to a lack of facility capacity?

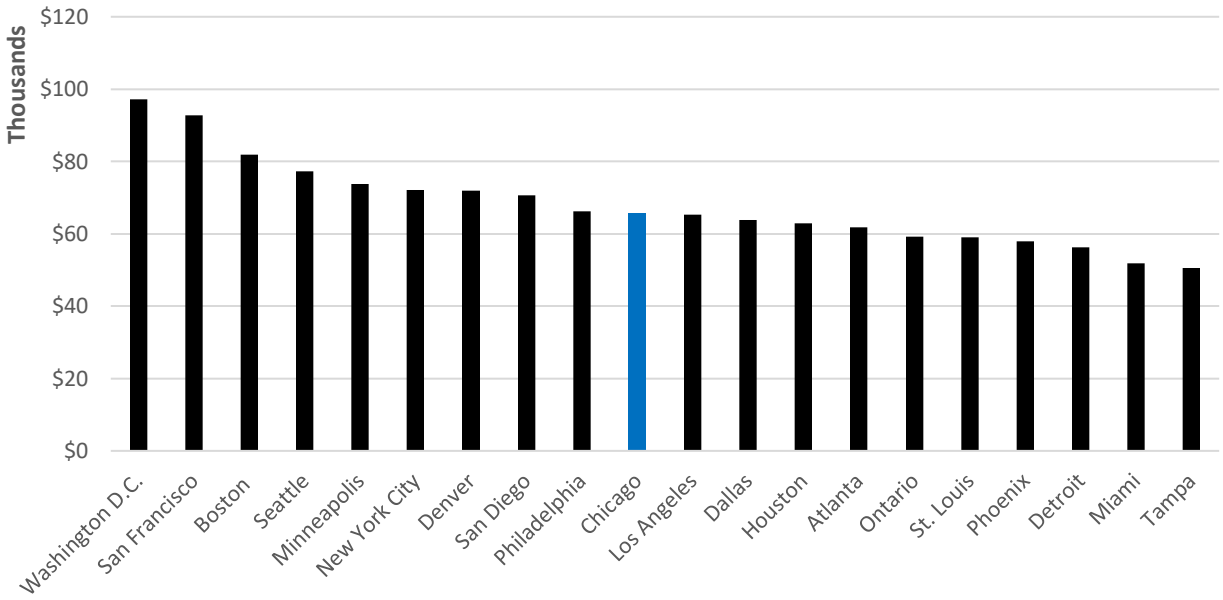
An airport's market area's ability to generate passenger traffic is directly related to its socioeconomic profile and its level of service. **Figures B-1** and **B-2** present the essence of Chicago's ability to generate traffic. First, Chicago is the third largest MSA in the U.S. based on population, following New York and Los Angeles. Chicago's rank based on Median Household Income, which is often shown as the primary determinant of passenger generation per capita, is tenth, following other more affluent markets such as Washington D.C., San Francisco, Boston, and Seattle.

## FIGURE B-1
## TOP 20 LARGEST U.S. MARKETS BASED ON POPULATION (CY 2017, MILLIONS)




Source: American Community Survey; Note: Uses CY 2017 demographic data because it was the latest available at the time of the report

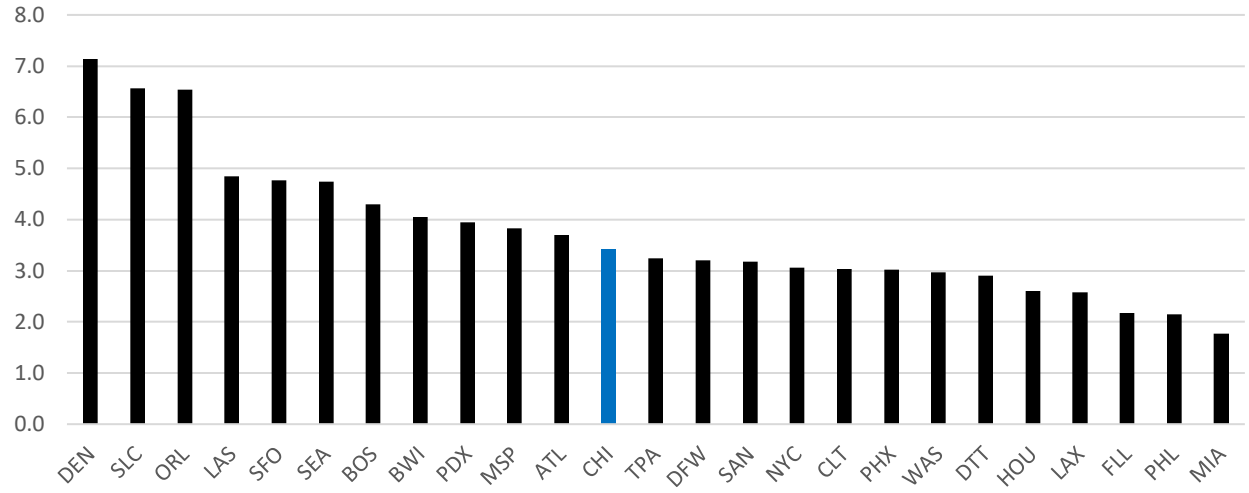
## FIGURE B-2
## TOP 20 LARGEST U.S. MARKETS MEDIAN HOUSEHOLD INCOME (CY 2017, THOUSANDS)




Source: American Community Survey Note: Uses CY 2017 demographic data because it was the latest available at the time of the report

As shown in **Figure B-3**, Chicago's passenger origination per capita ranks 12th, following most of the markets with higher income and two markets with high levels of service relative to its population: the leisure destinations of Orlando and Las Vegas. Originating O&D trips per capita is an industry-wide benchmark to demonstrate the economy's propensity to generate trips. Chicago's ranking of 12th is consistent with its ranking of tenth in terms of Median Household Income as opposed to its Population ranking of third.

## FIGURE B-3
## RANKING OF LARGE HUB MARKETS ORIGINATING O&D TRIPS PER CAPITA (CY 2018)

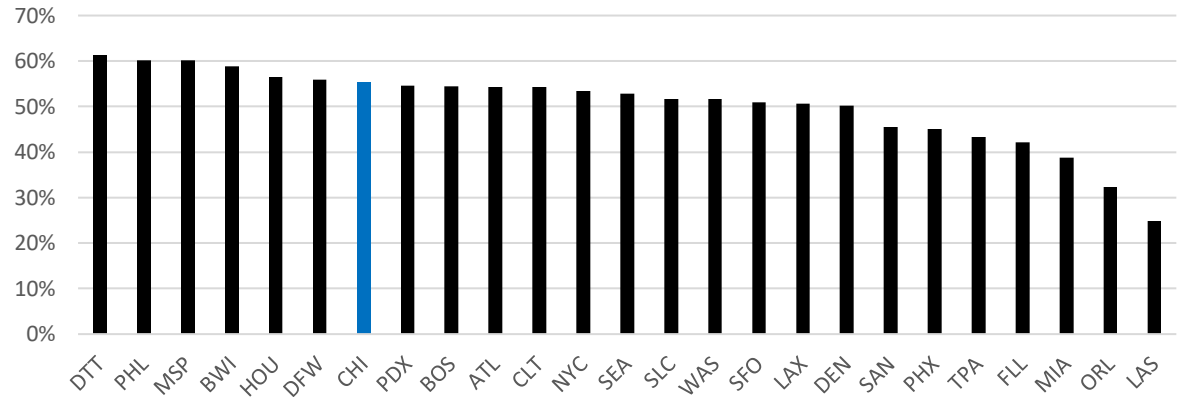



Sources: US DOT O&D Survey, Sabre Marketing Information Data Tapes (MIDT), and American Community Survey

#### B.5.2.3 How does Chicago perform vis-à-vis other major cities in attracting visitors?

A ratio of 50 percent originating and 50 percent visiting reflects a balanced market. Chicago originates 55 percent of its traffic, as seen in **Figure B-4**, and attracts 45 percent of its traffic. This results in the seventh-highest originating market among U.S. Large Hub markets. While indicating a lower relative visitor rate, it is in line with the other mega-hubs of Dallas and Atlanta. In comparison, Chicago contrasts sharply with Orlando and Las Vegas, both well-known predominantly visitor markets with originating shares of 32 percent and 25 percent respectively.

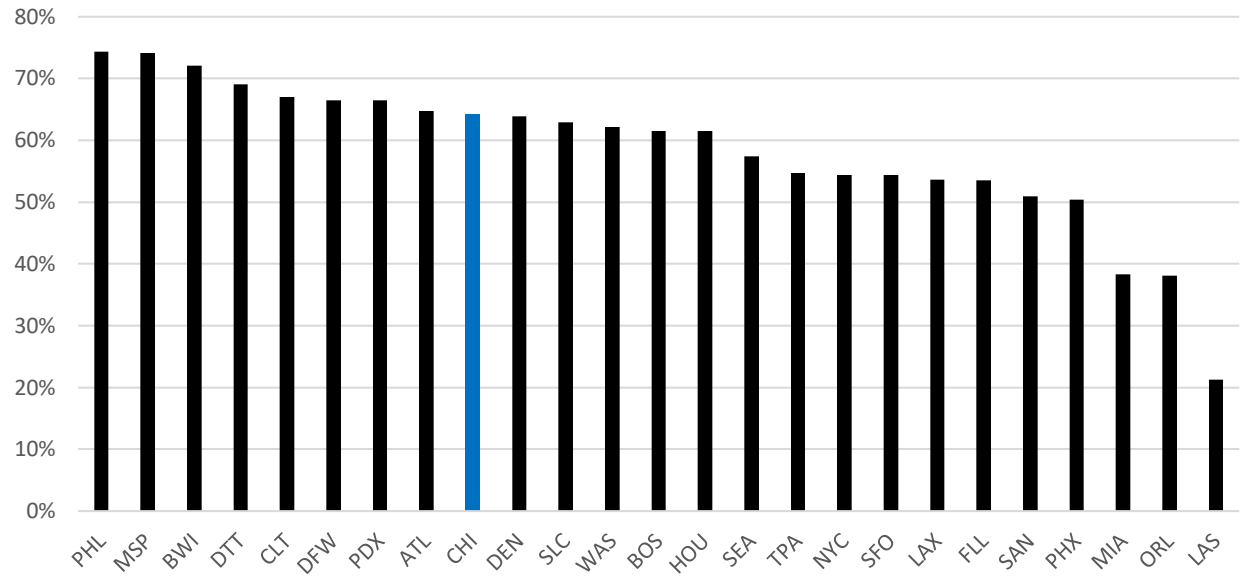
## FIGURE B-4
## LARGE HUB MARKETS ORIGINATING SHARE OF O&D (CY 2018)




Sources: US DOT O&D Survey, Sabre MIDT

**Figure B-5** depicts the large hub markets origination share of international traffic, which offers partial explanation for the imbalance in originating travel versus incoming travel. Internationally, Chicago is almost two-thirds originating, ranking it ninth among the U.S. Large Hub markets for originations. This level of international origination remains consistent with other large markets that generate more traffic than they attract and where the supply of airline services is not constrained. Rather, it is consistent with the trend in the U.S. industry caused by the strength of the U.S. economy and the resultant strength in the U.S. dollar.

## FIGURE B-5
## LARGE HUB MARKETS SHARE OF INTERNATIONAL ORIGINATING O&D (CY 2018)

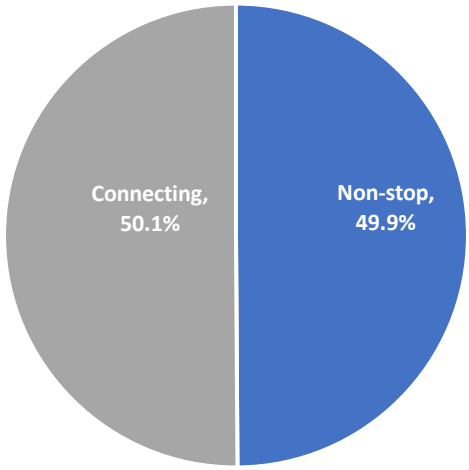



Source: Sabre MIDT

### B.5.2.4 Is O'Hare underserved internationally? What share of international O&D passengers travel on a non-stop international flight from O'Hare versus taking a connecting flight, and how does this compare to other major cities?

A key metric of the adequacy of air travel is the share of passengers that can reach their destination on a non-stop flight versus making a connection at another gateway. **Figure B-6** demonstrates that approximately half of O'Hare's international O&D traffic travels non-stop.

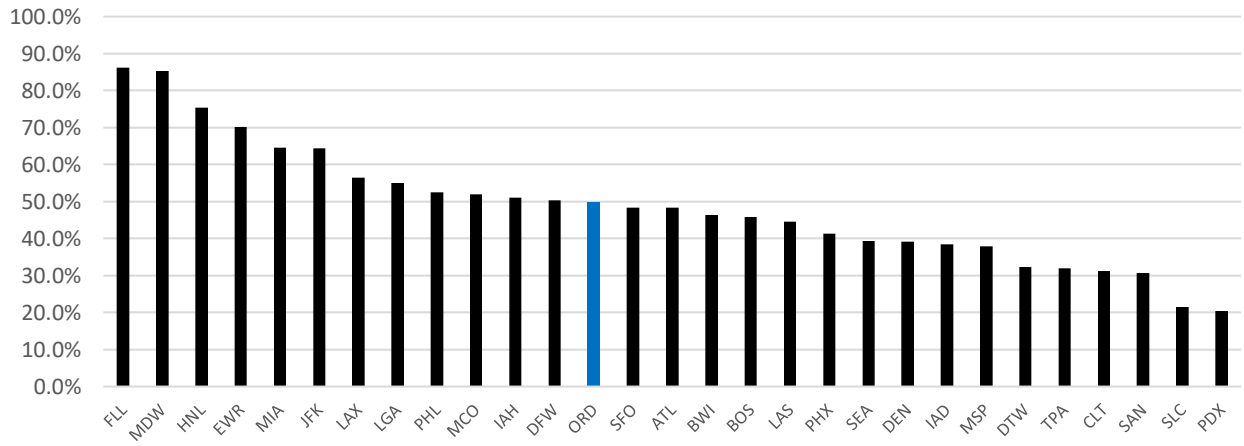
## FIGURE B-6
## O'HARE INTERNATIONAL O&D SHARE, FLYING NON-STOP VS. CONNECTING (CY 2018)




Source: Sabre MIDT

This metric is compared to the largest markets in **Figure B-7**. O'Hare's non-stop share is low compared to other major airports. Fort Lauderdale and Miami rank first and third respectively, but this reflects their dominance in the Caribbean and Central American markets, and in the case of Miami, its dominance in South America. Chicago's lower ranking is largely driven by its Midwestern location. Coastal cities have an advantage as international gateways across the Atlantic and Pacific. Chicago's Midwest location results in a geographic disadvantage to major international markets.

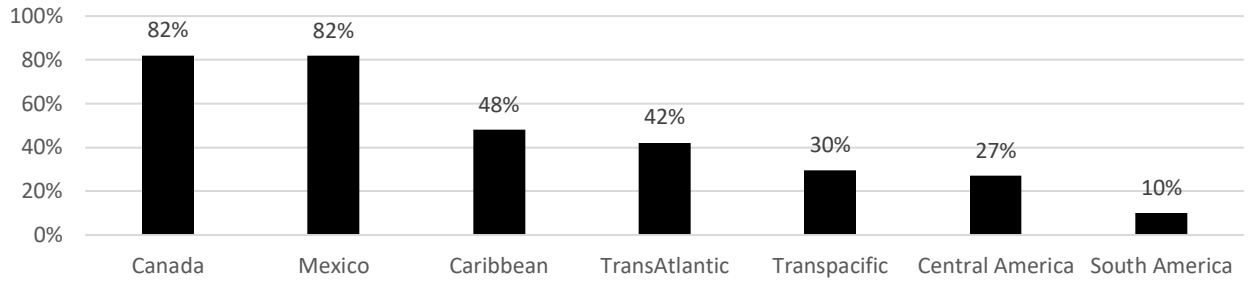
## FIGURE B-7
## LARGE HUB MARKETS INTERNATIONAL O&D SHARE, FLYING NON-STOP (CY 2018)




Source: Sabre MIDT (excludes MDW, LGA, and DCA), U.S. contiguous states only

The relative ranking by world area in **Figure B-8** supports the theory that the geographic location of Chicago plays a role in the Chicago traveler's ability to travel non-stop. Chicago is a significant gateway to Canada and Mexico, and air service at O'Hare reflects that. As **Figure B-8** indicates, 82 percent of passengers are able to fly non-stop to these markets from O'Hare. Of passengers traveling between O'Hare and the Caribbean, 48 percent fly non-stop. Similarly, 42 percent of passengers on transatlantic journeys use non-stop flights from O'Hare. Passengers to other regions are far more likely to require a connecting itinerary.

## FIGURE B-8
## O'HARE'S INTERNATIONAL O&D SHARE, FLYING NON-STOP BY SEGMENT (CY 2018)




| O'Hare's Rank in U.S. Large Hub Markets | | | | | | |
|---|---|---|---|---|---|---|
| **Canada** | **Mexico** | **Caribbean** | **Transatlantic** | **Transpacific** | **Central America** | **South America** |
| 3 | 8 | 13 | 9 | 7 | 11 | 12 |

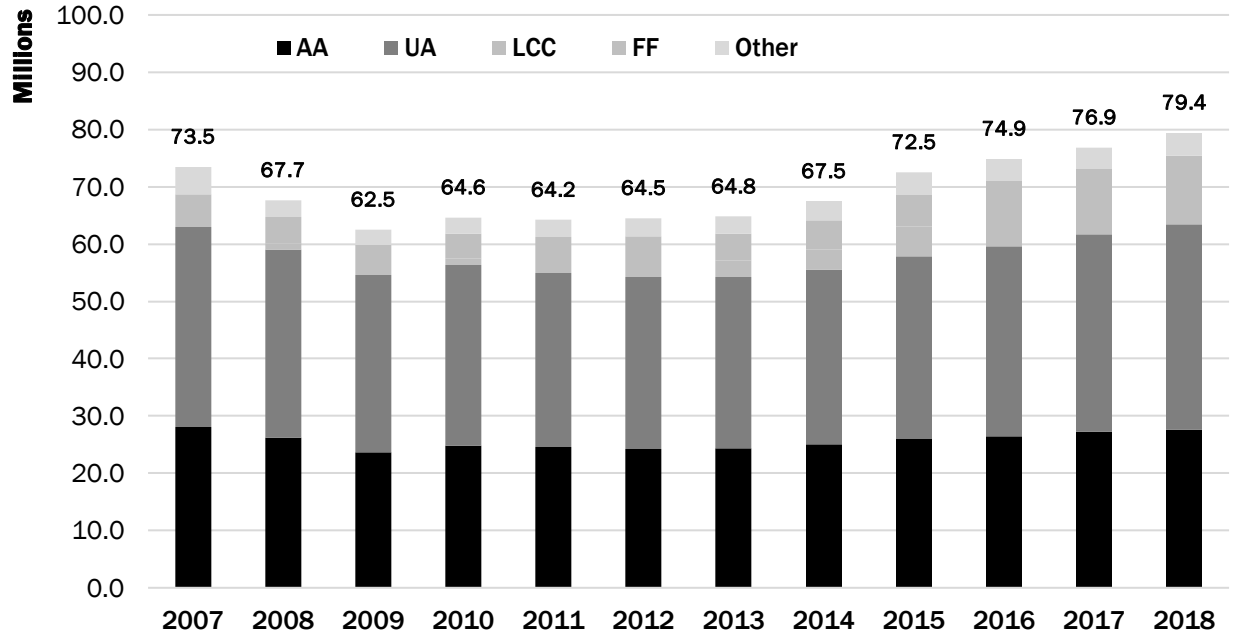
Source: Sabre MIDT (excludes MDW, LGA, and DCA), U.S. contiguous states only

### B.5.2.5 Did the gate reallocations at O'Hare stemming from mergers stimulate passenger increases by LCCs[9]/Ultra Low Cost Carriers (ULCCs)?[10]

Over the last decade at O'Hare, passenger traffic has grown at a CAGR of 1.6 percent, reaching 79.4 million passengers in 2018. During this period, after undergoing mergers (United/Continental in 2010 and American/US Airways in 2013) which caused the consolidated carriers to release gates, both American and United experienced declines in market share. Beginning in 2011, LCCs have gradually been capturing a larger share of the O'Hare market, as seen in **Figure B-9**.

[9] Low Cost Carriers are airlines that try to maintain lower operating costs. Examples of an LCC are Southwest and JetBlue.
[10] Ultra Low Cost Carriers are airlines that try to maintain lower operating costs and offer a no-frills travel experience. Examples of ULCCs are Spirit, Allegiant, and Frontier.

## FIGURE B-9
## O'HARE'S HISTORICAL PASSENGER TRAFFIC (CY 2007-18)

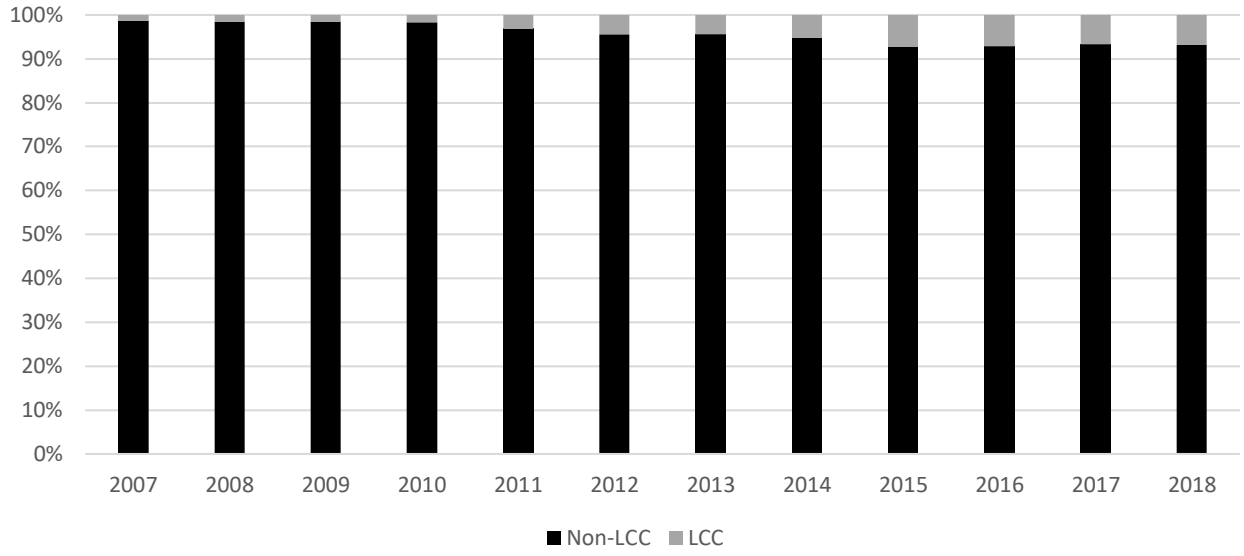



| Carrier Share | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AA | 38.2% | 38.7% | 37.8% | 38.3% | 38.4% | 37.6% | 37.6% | 37.1% | 35.8% | 35.3% | 35.4% | 34.7% |
| UA | 47.5% | 48.6% | 49.6% | 48.9% | 47.2% | 46.5% | 46.0% | 45.2% | 43.9% | 44.3% | 44.9% | 45.2% |
| LCC | 1.4% | 1.5% | 1.6% | 1.7% | 3.1% | 4.4% | 4.5% | 5.2% | 7.2% | 7.2% | 6.7% | 6.8% |
| Foreign Flag (FF) | 6.3% | 6.9% | 6.8% | 6.7% | 6.6% | 6.7% | 7.3% | 7.6% | 7.6% | 7.9% | 8.1% | 8.3% |
| Other | 6.5% | 4.3% | 4.2% | 4.4% | 4.7% | 4.8% | 4.6% | 4.9% | 5.4% | 5.2% | 4.9% | 5.0% |

Source: USDOT T-100

In 2018, LCC passengers accounted for 6.8 percent of O'Hare's traffic, up from 1.5 percent in 2008, as seen in **Figure B-10**. Despite growing five percentage points, the LCC passenger share at O'Hare continues to lag behind the industry average of 14.9 percent. Over the last decade, seven new LCC airlines, most of which were international operators, began serving O'Hare. Much of the LCC disparity experienced at O'Hare can be attributed to Southwest Airlines (Southwest) operations out of Chicago Midway International Airport (Midway).

## FIGURE B-10
## HISTORICAL SHARE OF LCC PASSENGERS AT O'HARE (CY 2007-18)

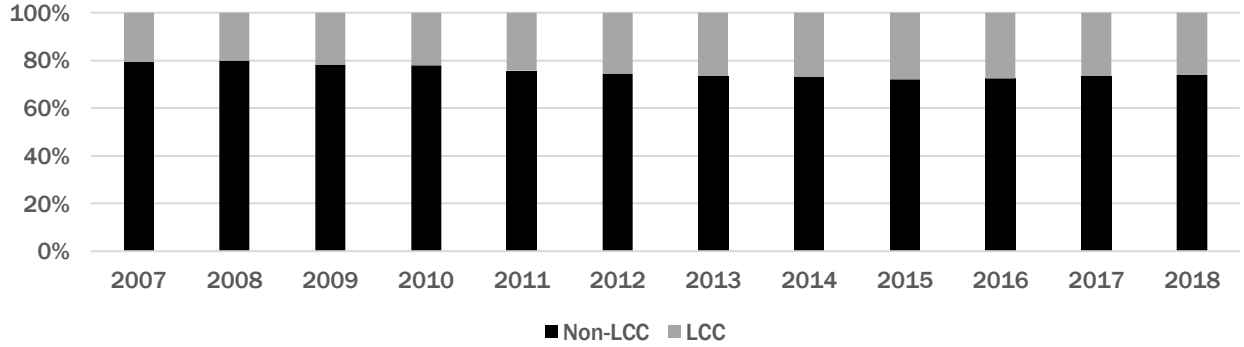



| U.S. LCC Share of the Industry (Excluding Southwest) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
| Share | 10.9% | 11.7% | 12.3% | 12.9% | 14.1% | 14.2% | 13.8% | 13.1% | 11.9% | 13.2% | 14.0% | 14.9% |

Source: USDOT T-100

As seen in **Figure B-11**, when O'Hare passengers are combined with Midway's, and Southwest is included in the analysis, Chicago's share of LCCs is only slightly lower than the industry-wide LCC share (25.8 percent versus 30.5 percent), highlighting the significant presence Southwest has not only at Chicago but also industry-wide. This also indicates that the Chicago market is in line with the industry and not underrepresented by LCCs.

## FIGURE B-11
## CHICAGO (ORD/MDW) HISTORICAL SHARE OF LCC PASSENGERS (CY 2007-18)

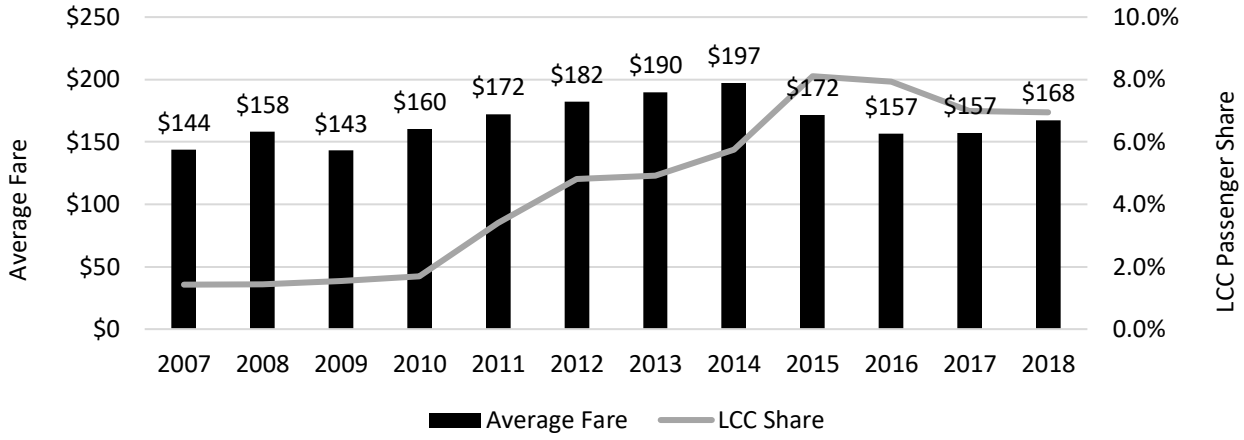


| U.S. Industry LCC Share | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
| Share | 23.6% | 24.8% | 25.9% | 26.6% | 28.0% | 28.1% | 27.9% | 28.2% | 28.2% | 29.3% | 30.1% | 30.5% |

Source: USDOT T-100

As LCCs significantly increase their presence at an airport previously dominated by legacy carriers, the airlines typically enter a competitive price war, in which both airlines drop fares on shared routes to drive the other carrier out and capture a larger market share. This trend occurred at O'Hare beginning in 2015 as the LCC carriers increased their share of domestic passengers. During this time, and in the subsequent two years, the average domestic fare at the airport dropped by 15 percent, from $197 in 2014 to $168 in 2018 (as seen in **Figure B-12**).

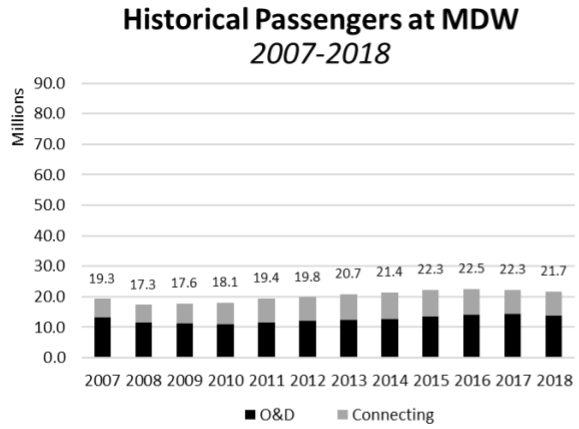
## FIGURE B-12
## AVERAGE DOMESTIC FARE AND LCC DOMESTIC SHARE AT O'HARE (CY 2007-18)



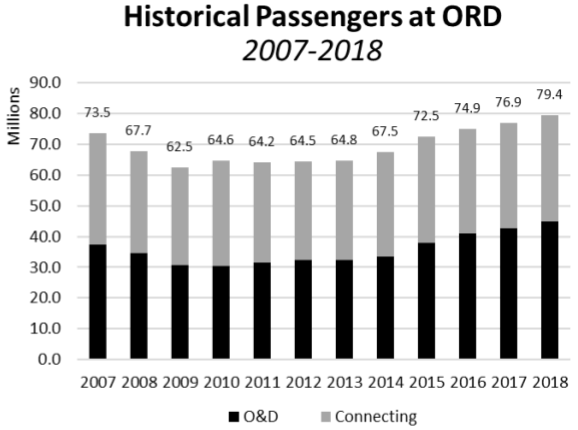

Sources: USDOT O&D Survey and Sabre MIDT

With Southwest's operations at Midway accounting for more than 80 percent of domestic LCC passengers in Chicago, Midway weathered the great recession better than O'Hare, as seen in **Figure B-13**, despite having significantly lower annual passengers. However, the emergence of LCC's at O'Hare resulted in its passenger traffic growth outpacing growth at Midway, with an average annual growth rate of 4.2 percent over the last five years, compared to Midway's CAGR of 1.0 percent over the same time.

## FIGURE B-13
## HISTORICAL PASSENGERS AT MIDWAY AND O'HARE




| Domestic | O&D | Connecting | Total |
|---|---|---|---|
| 2008-2018 | 1.9% | 3.1% | 2.3% |
| 2013-2018 | 2.1% | -0.8% | 1.0% |




| Domestic | O&D | Connecting | Total |
|---|---|---|---|
| 2008-2018 | 2.7% | 0.4% | 1.6% |
| 2013-2018 | 6.8% | 1.2% | 4.2% |

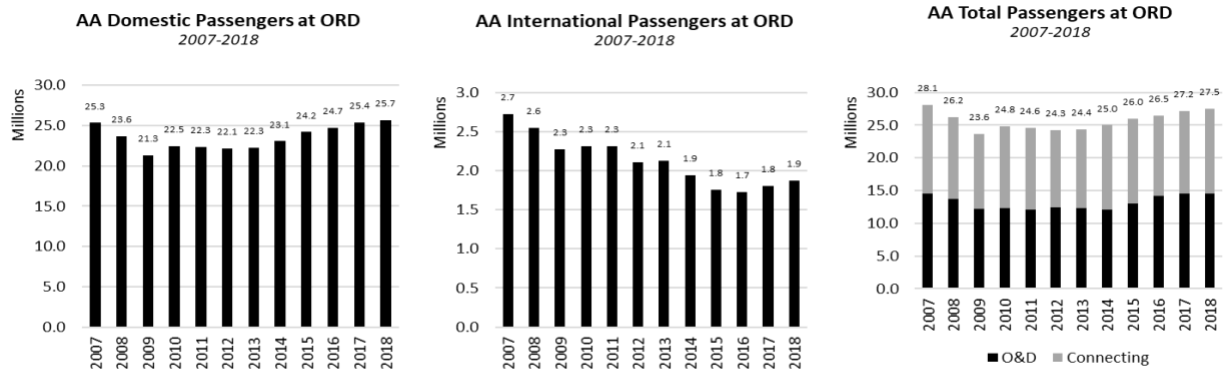
Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100

As discussed throughout this section, it was determined after analyzing the historic activity for LCCs at O'Hare, Midway, and nationwide that the gate reallocation at O'Hare which occurred due to the airline mergers did not appear to stimulate low-cost carrier demand above what was experienced industry-wide. LCC's share at O'Hare is actually below the industry average.

#### B.5.2.6 Have facility constraints hampered O'Hare's role as a dual connecting hub for American Airlines and United Airlines?

**Figures B-14** and **B-15** present American's and United's passengers by year for the 2007–18 period, depicting O&D/Connecting trends as well as Domestic vs. International detail. Focusing first on the 10-year period, both carriers are growing at less than one percent annually. As already shown, the hub carriers share of O'Hare's traffic declined from 85.7 percent in 2007 to 79.9 percent in 2018. American's growth has been the slower of the two, with actual declines in international travel. For the most recent five-year period, American has shrunk internationally (by 2.5 percent) annually while growing domestically by 2.9 percent.

## FIGURE B-14
## AMERICAN PASSENGERS AT O'HARE (CY 2007-18)




| Domestic | CAGR |
|---|---|
| 2007-2009 | -8.2% |
| 2008-2018 | 0.8% |
| 2013-2018 | 2.9% |

| International | CAGR |
|---|---|
| 2007-2009 | -8.6% |
| 2008-2018 | -3.1% |
| 2013-2018 | -2.5% |

| Total | CAGR |
|---|---|
| 2007-2009 | -8.3% |
| 2008-2018 | 0.5% |
| 2013-2018 | 2.5% |

Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100

Compared to American, United had higher growth from 2013–2018, growing internationally and domestically for a combined annual rate of 3.8 percent. In addition, while American has been shrinking O'Hare's role as connecting hub (**Figure B-17**), United relies more on connecting traffic; 55 percent of United's O'Hare traffic is connecting, while American's connecting traffic in 2018 accounted for 47 percent of its onboard traffic. The number of connections made on United has increased by almost one million passengers since 2013, yet the high-growth segment for both carriers is in domestic traffic.

## FIGURE B-15
## UNITED PASSENGERS AT O'HARE (CY 2007-18)


| Domestic | CAGR |
|---|---|
| 2007-2009 | -5.7% |
| 2008-2018 | 0.8% |
| 2013-2018 | 4.0% |

| International | CAGR |
|---|---|
| 2007-2009 | -6.2% |
| 2008-2018 | 1.2% |
| 2013-2018 | 2.4% |

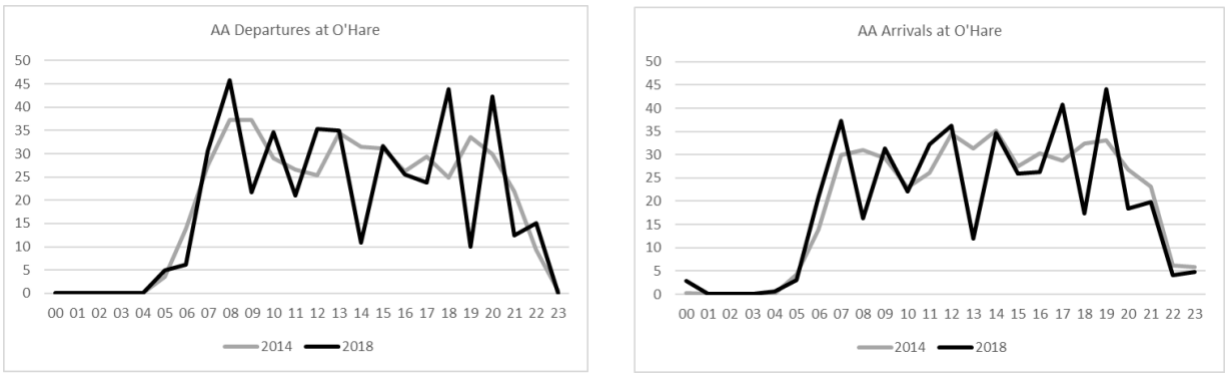
| Total | CAGR |
|---|---|
| 2007-2009 | -5.8% |
| 2008-2018 | 0.9% |
| 2013-2018 | 3.8% |

Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100

#### B.5.2.7 Was re-banking by American and United diminished by facility capacity constraints at O'Hare?

In 2015, American re-banked its Chicago hub into more pronounced banks to facilitate shorter connections, thereby maximizing the number of connections on flights. **Figure B-16** shows the resulting peaks for American and **Figure B-18** shows the same for United.

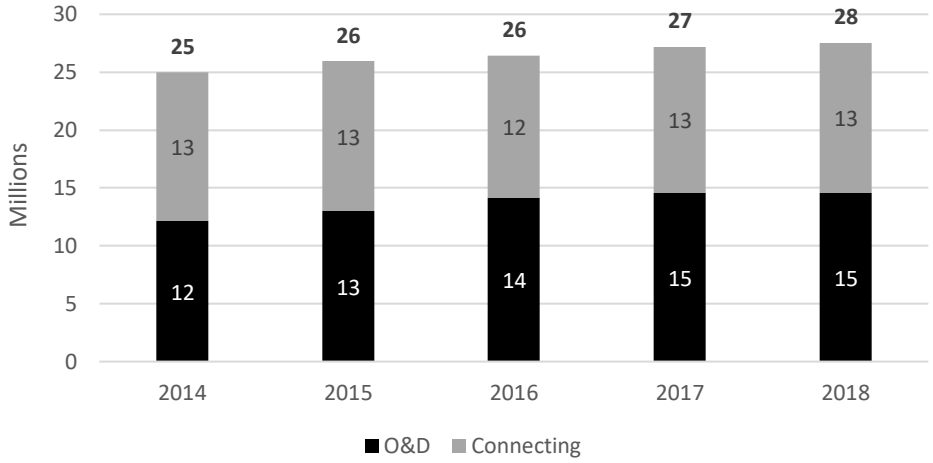
## FIGURE B-16
## AMERICAN'S DEPARTURES AND ARRIVALS AT O'HARE




Source: Innovata Schedules

Despite a more peaked schedule, American's connecting passengers at O'Hare only increased from 12.9 million in 2014 to 13 million in 2018, as seen in **Figure B-17**. Over the same period, American's O&D traffic increased by 2.4 million passengers.

## FIGURE B-17
## AMERICAN'S PASSENGER HISTORY AT O'HARE (CY 2014-18)

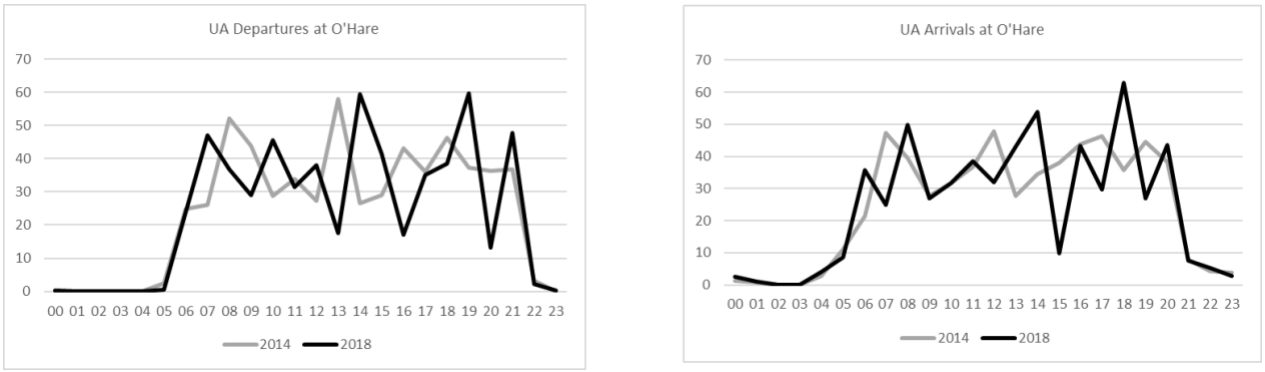



| CAGR (2014-18) | |
|---|---|
| O&D | 4.7% |
| Connecting | 0.2% |
| Total | 2.5% |

Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100

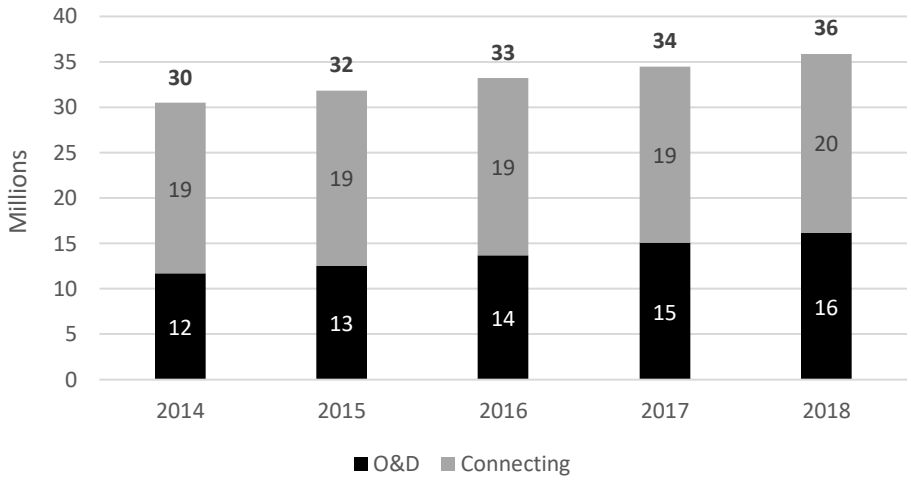
United Airlines also re-banked its O'Hare schedule to a hub with more pronounced peaks than American (**Figure B-18**). Since the re-banking, United has increased its connections by almost one million passengers, as seen in **Figure B-19**, while its O&D experienced an annual CAGR of 8.5 percent.

## FIGURE B-18
## UNITED'S DEPARTURES AND ARRIVALS AT O'HARE




Source: Innovata Schedules; average daily for 2014 and 2018 based on full year

## FIGURE B-19
## UNITED'S PASSENGER HISTORY AT O'HARE (CY 2014-18)

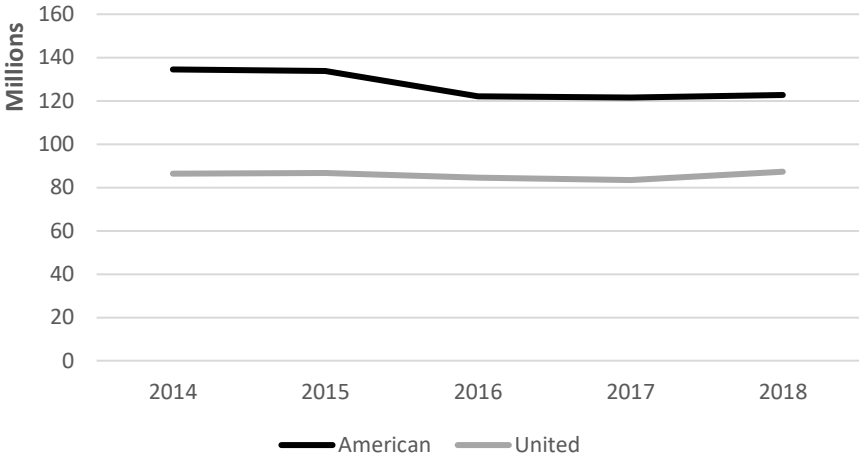



| CAGR (2014-18) | |
|---|---|
| O&D | 8.5% |
| Connecting | 1.2% |
| Total | 4.2% |

Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100

The nominal rebanking outcomes do not indicate facility constraints at O'Hare. Rather, the outcomes align to American's systemwide trend of connecting passenger totals having declined since 2014, while United's have risen 0.3 percent annually in the same period (**Figure B-20**).

## FIGURE B-20
## AMERICAN'S AND UNITED'S SYSTEMWIDE CONNECTING PASSENGERS (CY 2014-18, MILLIONS)



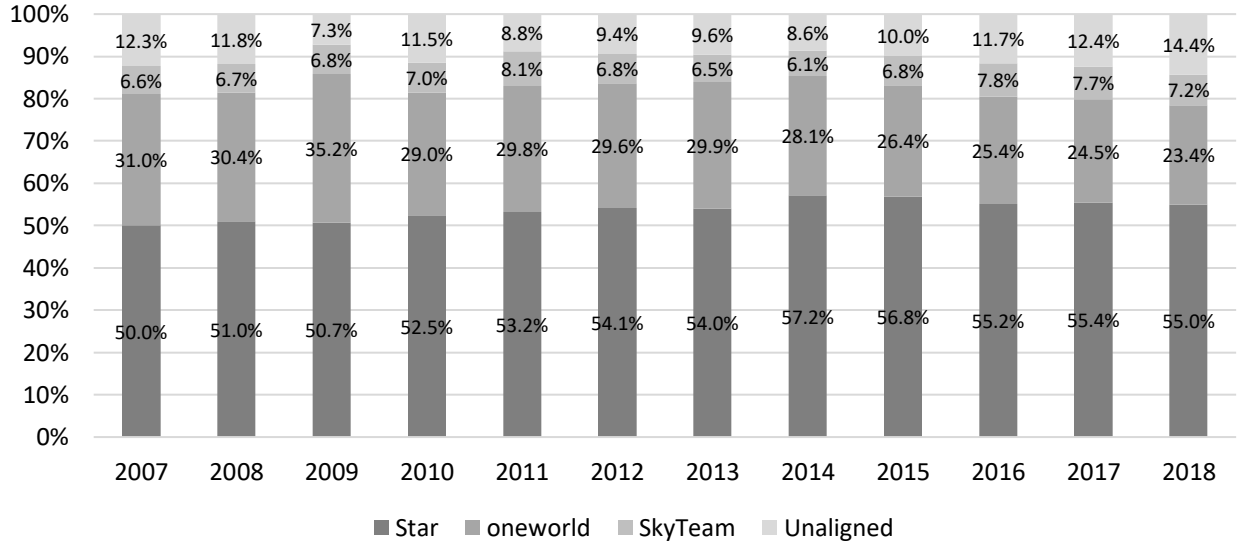

| | |
|---|---|
| | |
| United | 0.3% |

Sources: USDOT O&D Survey, Sabre MIDT, and USDOT T-100 (excludes territories)

### B.5.2.8 Does room exist for international passengers carried by alliances other than Star and oneworld?

As seen in **Figure B-21**, Star Alliance has increased its share of international passengers at O'Hare while oneworld has lost share. The unaligned carriers re-emerged in 2014 and now account for 14.4 percent of O'Hare's international passengers. While this is lower than the industry share carried by the unaligned carriers, it is consistent with the share that unaligned airlines capture at carrier hubs.

## FIGURE B-21
## HISTORICAL SHARE OF O'HARE INTERNATIONAL PASSENGERS BY ALLIANCE (CY 2007-18)



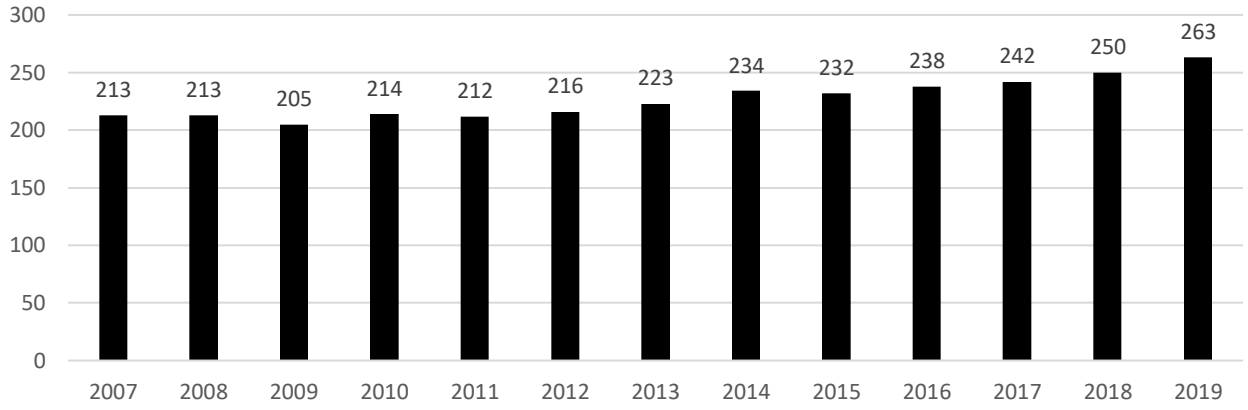
| U.S. Industry Unaligned Share of international | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
| Share | 24.4% | 21.4% | 20.0% | 23.2% | 21.8% | 20.4% | 19.9% | 20.7% | 22.4% | 23.8% | 25.2% | 26.7% |

Source: USDOT T-100

#### B.5.2.9 Have new destinations been added at O'Hare?

One possible sign that facility constraints are limiting options for travelers is a lack of new market development. In a healthy market, new destinations are added as 1) growth markets for existing carriers and 2) new markets for new carriers. Prior to 2013, O'Hare's non-stop markets served remained below 220, as seen in **Figure B-22**. Since 2013, the number of markets served grew from 223 to 263 in 2019. As seen in **Table B-5**, many of these new markets are smaller domestic points served by regional carrier partners of United or American, but 22 are international markets. The majority of these new city pairs were not constrained by lack of gate availability.

## FIGURE B-22
## NUMBER OF NON-STOP DESTINATIONS SERVED FROM O'HARE (CY 2007-19)




Source: Innovata Schedules

## TABLE B-5
## NEW MARKETS SERVED AT O'HARE SINCE 2013

| New Domestic Markets | | |
|---|---|---|
| **Market** | **Started Service** | **Daily Departures** |
| State College | 2014 | 5.0 |
| Erie | 2014 | 2.0 |
| Bismarck | 2014 | 2.0 |
| Ironwood | 2014 | 2.0 |
| Mason City | 2014 | 2.0 |
| Bangor | 2014 | 1.0 |
| Trenton | 2014 | 0.5 |

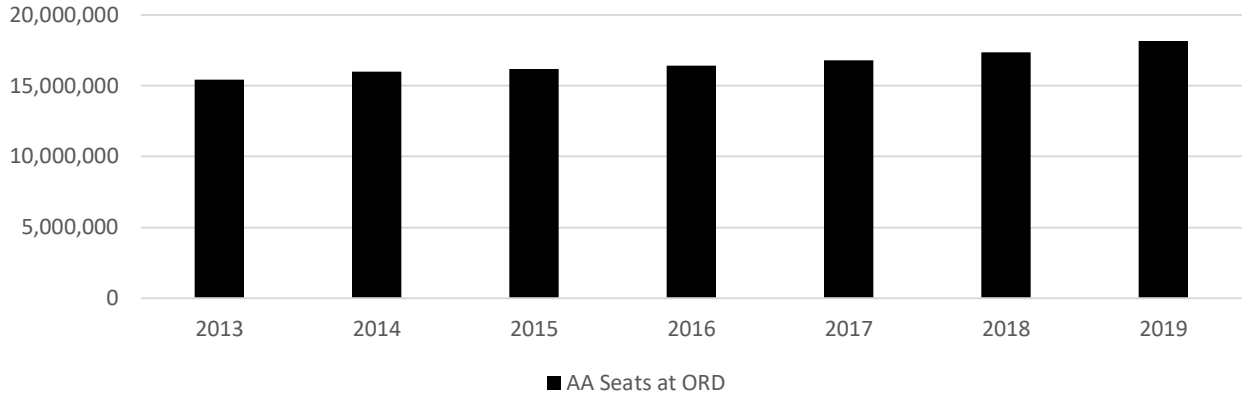
| New Domestic Markets | | |
|---|---|---|
| **Market** | **Started Service** | **Daily Departures** |
| Oakland | 2014 | 0.5 |
| Great Falls | 2016 | 0.2 |
| Augusta | 2016 | 0.0 |
| Quincy | 2017 | 2.0 |
| Meridian | 2017 | 1.0 |
| Clarksburg | 2017 | 1.0 |
| Key West | 2017 | 1.0 |
| Cape Girardeau | 2017 | 1.0 |
| Wilmington | 2018 | 2.0 |
| Lewisburg | 2018 | 1.0 |
| Staunton | 2018 | 1.0 |
| Salina | 2018 | 1.0 |
| Fresno | 2018 | 0.7 |
| Harlingen | 2018 | 0.2 |
| Brownsville | 2018 | 0.1 |
| Sun Valley | 2018 | 0.1 |
| Joplin | 2019 | 1.0 |
| Ogdensburg | 2019 | 0.6 |
| Eugene | 2019 | 0.5 |
| Redmond | 2019 | 0.4 |
| Watertown | 2019 | 0.3 |
| Mobile | 2019 | 0.2 |
| Branson | 2019 | 0.2 |
| Panama City | 2019 | 0.1 |
| Fort Walton Beach | 2019 | 0.1 |
| Hilton Head Island | 2019 | 0.1 |
| Durango | 2019 | 0.1 |
| Grand Junction | 2019 | 0.1 |
| Cody | 2019 | 0.0 |
| **New International Markets** | | |
| **Market** | **Started Service** | **Daily Departures** |
| Dubai | 2014 | 1.0 |
| Edinburgh | 2014 | 0.4 |
| Belize City | 2015 | 0.3 |
| Reykjavik | 2016 | 1.0 |
| Tokyo-Haneda | 2016 | 1.0 |
| Taipei | 2016 | 0.6 |

| New Domestic Markets | | |
|---|---|---|
| **Market** | **Started Service** | **Daily Departures** |
| Providenciales | 2016 | 0.2 |
| Ixtapa/Zihuantanejo | 2016 | 0.1 |
| Saint Lucia | 2016 | 0.1 |
| Barcelona | 2017 | 0.7 |
| Krakow | 2017 | 9.2 |
| Leon-Guanajuato | 2018 | 2.0 |
| Addis Ababa | 2018 | 0.6 |
| Venice | 2018 | 0.5 |
| London | 2018 | 0.5 |
| Auckland | 2018 | 0.4 |
| Budapest | 2018 | 0.3 |
| Bogota | 2018 | 0.2 |
| Lisbon | 2019 | 0.4 |
| Athens | 2019 | 0.4 |
| Queretaro | 2019 | 0.2 |
| Chengdu | 2019 | 0.1 |
| Source: Innovata Schedules, New Markets Since 2013 | | |

#### B.5.2.10 Did the L-Stinger Gates increase American's growth, suggesting pent-up demand? And was United's increase in destinations in 2018/2019 a competitive response to American?

Historically, American has grown O'Hare's seat capacity faster than the industry average; however, the differential virtually disappeared in 2019. This would suggest that the growth at O'Hare was consistent with the growth American had system-wide rather than stimulated by the availability of the L-Stinger gates, which opened in May of 2018. As shown in **Figure B-23**, American's seat capacity at O'Hare increased 2.4 percent annually from 2013 through 2018, compared to 0.9 percent systemwide over the same period. In contrast, American's seat capacity at O'Hare increased 4.6 percent in 2019, compared to 4.5 percent systemwide the same year.

## FIGURE B-23
## AMERICAN'S SEAT CAPACITY AT O'HARE (CY 2013-19)

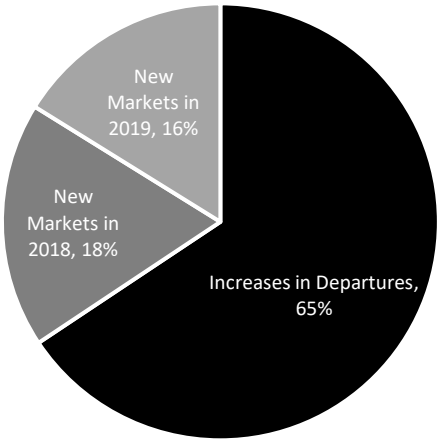



| American's Seat Capacity Growth at O'Hare and the U.S. Industry | | | | | | |
|---|---|---|---|---|---|---|
| | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
| O'Hare | 3.5% | 1.2% | 1.3% | 2.5% | 3.3% | 4.6% |
| U.S. | 1.3% | 0.8% | 0.4% | 0.0% | 2.1% | 4.5% |

Source: Innovata Schedules

American's increase in O'Hare service in 2019 is derived from 36 new markets and an increase in departures in existing markets. As shown on Figure B-24, increases in American flights from 2017 through 2019 were on existing routes 65 percent of the time and new routes 35 percent of the time.

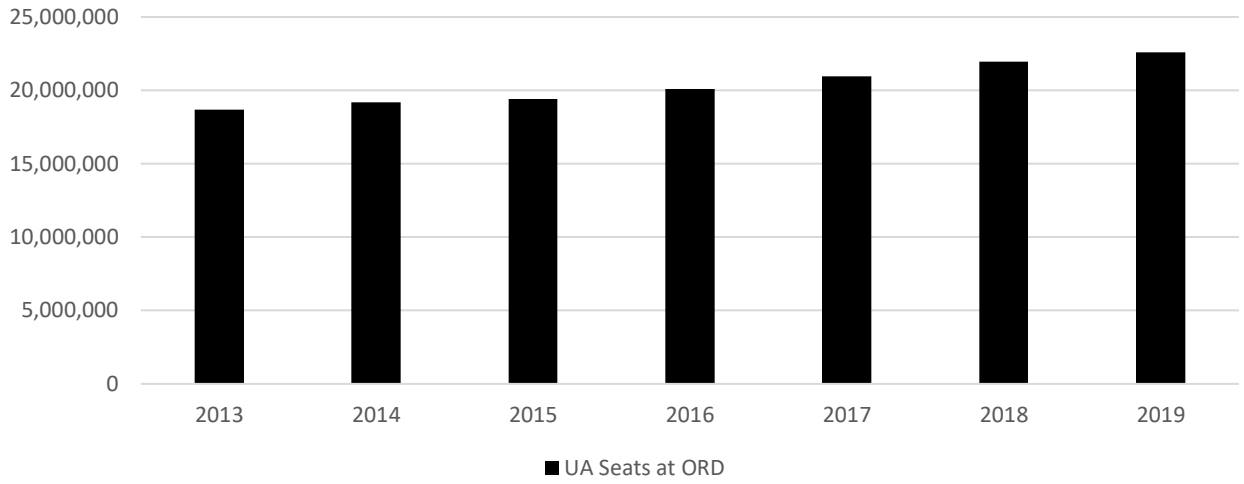
## FIGURE B-24
## SOURCES OF AMERICAN'S DEPARTURE GROWTH (CY 2017-19, TOTAL INCREASE OF 18,000)




Source: Innovata Schedules, pulled July 11, 2019

As shown in **Figure B-25**, United has been growing at O'Hare since 2013. From 2013 through 2016, United grew seat capacity at O'Hare at a faster rate than did the overall airline industry. Since the L-Stinger gates came online in 2018, United has grown capacity at O'Hare more slowly than the broader airline industry.

## FIGURE B-25
## UNITED'S SEAT CAPACITY AT O'HARE (CY 2013-19)




**United's Seat Capacity Growth at O'Hare and the U.S. Industry**

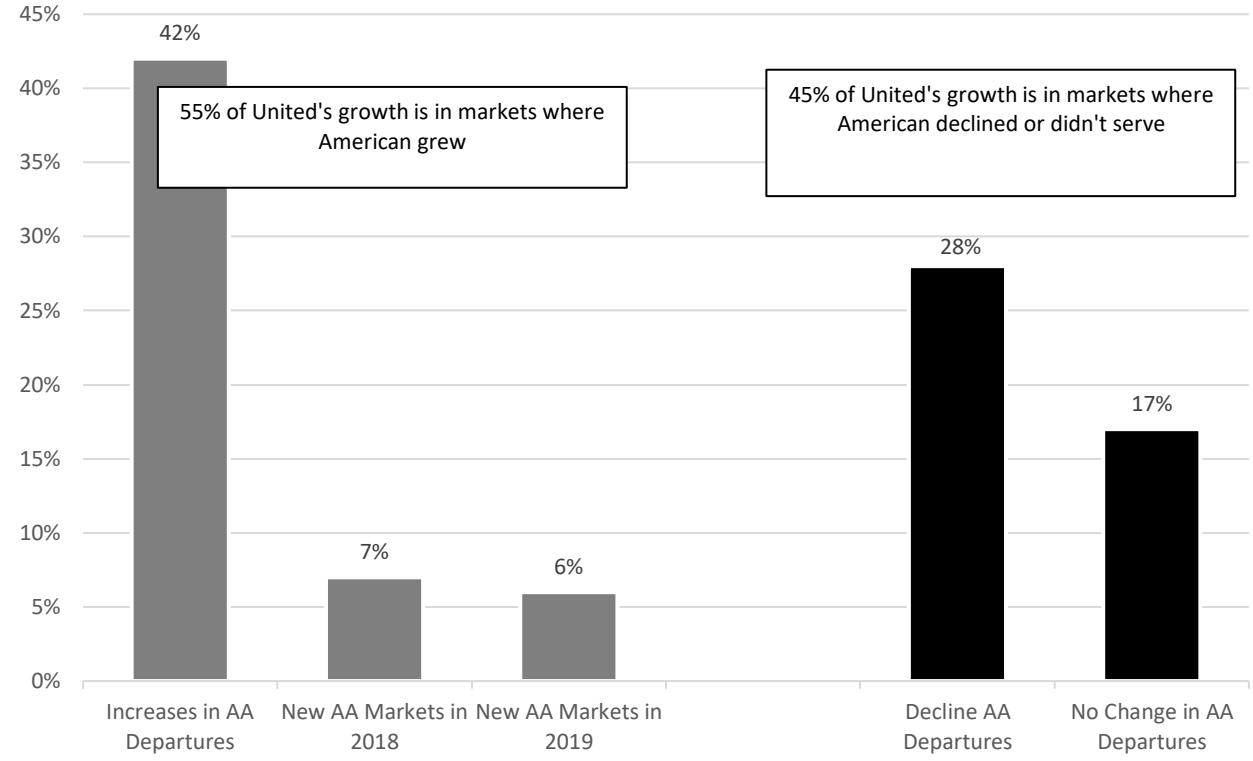
| Location | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| O'Hare | 2.8% | 1.0% | 3.5% | 4.3% | 4.8% | 2.9% |
| U.S. | -1.5% | 0.1% | 1.8% | 4.5% | 6.3% | 4.0% |

Source: Innovata Schedules

**Figure B-26** categorizes United's growth at Chicago into American's growth segments. While 55 percent of United's increase in departures overlaps with American's increase, 45 percent of United's increase were either in markets that American has no presence or in markets where American has declined during that same time. This suggests that United's growth was not in direct response to American's growth during the 2017–19 span. Rather, United's growth is in response to United's strategy of strengthening the O'Hare hub to improve its connectivity.[11]

[11] United Airlines 4Q/FY 2016 Earnings Call; 9cbedd9b-7cca-430f-ab34-b600024be162 (united.com); Slide 10

## FIGURE B-26
## SOURCES OF UNITED'S DEPARTURE GROWTH SORTED BY AMERICAN'S GROWTH CATEGORIES (CY 2017-19, TOTAL INCREASE OF 23,000)




Source: Innovata Schedules, Pulled July 11, 2019

#### B.5.2.11 FAA's Third Party Consultant Induced Demand conclusions

The FAA's Third Party Consultant analyzed a series of factors that illustrated the passenger traffic response to the easing of capacity constraints over the most recent 12-year period (2007–18) through adding new runway capacity (and subsequent easing schedule limits) or adding gates. The FAA's Third Party Consultant concluded that the growth that occurred at O'Hare is consistent with that of the airline industry and does not indicate the existence of pent-up demand in the time analyzed.

### B.5.3 FAA's Third Party Consultant Passenger Forecast Conclusions

Based on the analysis the CDA provided on passenger trends at Chicago historically and for the future, the 2018 TAF growth rate for enplanements is reasonable and appropriate for environmental analysis for this EA. The CDA conducted a regression analysis and a market share forecast that supported the TAF's 2018 growth rate of 2.1 percent per year. The FAA's Third Party Consultant analyzed O'Hare's historical passenger trends to understand whether O'Hare's passenger demand was suppressed in the past due to airport facility constraints; the independent analysis concluded that constraints have not led to pent-up demand in the Chicago market in the time analyzed.

## B.6 AIRCRAFT OPERATIONS ANALYSIS

### B.6.1 Passenger Aircraft Operations Forecast

As had been done for the enplanement forecast, the CDA analyzed the FAA's 2018 TAF passenger aircraft operations forecast for O'Hare for this EA. However, while the enplanement forecast is projected to grow by 2.6 percent over the next five years, the TAF is forecasting a decline in annual passenger aircraft operations in the near-term at an average of -1.5 percent per annum as seen in **Table B-6**.

## TABLE B-6
## FAA TAF FOR O'HARE – CALENDAR YEARS

| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | CAGR |
|---|---|---|---|---|---|---|---|
| Enplaned Passengers | 40,312,189 | 42,185,986 | 43,212,898 | 44,146,257 | 45,029,152 | 45,879,185 | 2.6% |
| Y-o-Y Growth (%) | | 4.6% | 2.4% | 2.2% | 2.0% | 1.9% | |
| Passenger Aircraft Operations | 898,362 | 921,599 | 894,002 | 884,341 | 858,687 | 832,626 | -1.5% |
| Y-o-Y Change (%) | | 2.6% | -3.0% | -1.1% | -2.9% | -3.0% | |
| Note: The TAF is converted from federal fiscal years to calendar years<br>Source: Federal Aviation Administration, 2018 Terminal Area Forecast | | | | | | | |

This decline in passenger aircraft operations caused the CDA to further analyze the TAF operations forecast. As a result, several potential issues were identified:

1. The TAF assumes that all 50-seat regional jet aircraft will be retired by 2023
2. The TAF combines cargo operations with passenger operations

While the TAF forecast was deemed adequate for future enplanement growth, it is the view of both the CDA and the FAA's Third Party Consultant that passenger aircraft operations in the TAF are underrepresented at O'Hare. An adjusted passenger operations forecast was developed and is shown in **Attachment B-2** and shown in **Table B-7**.

## TABLE B-7
## PASSENGER AIRCRAFT OPERATIONS – CALENDAR YEARS

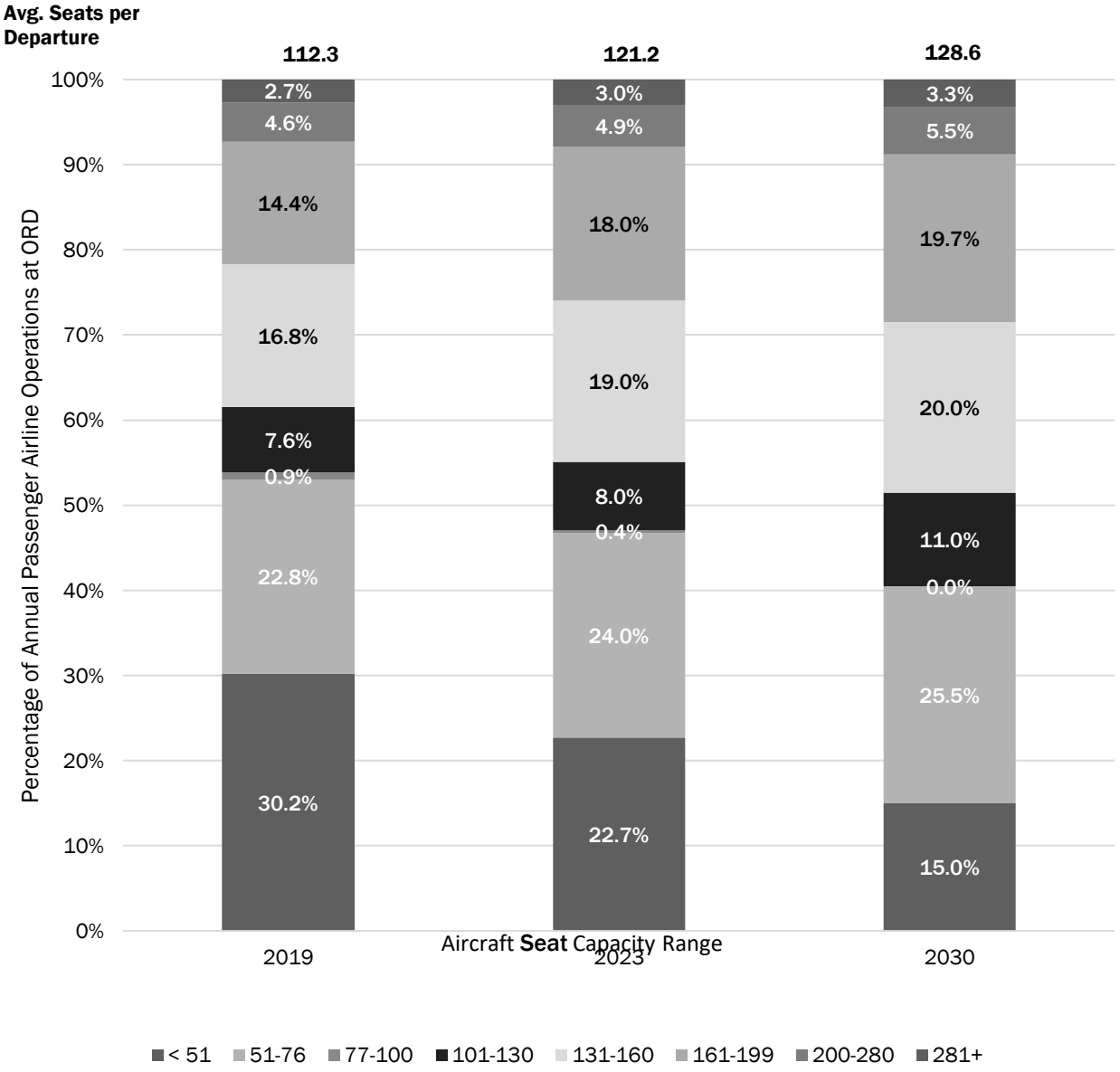
| Year | Total Enplaned Passengers | Total Passenger Aircraft Operations |
|---|---|---|
| **Historical** | | |
| 2006 | 38,122,240 | 932,874 |
| 2007 | 37,402,803 | 913,945 |
| 2008 | 34,890,004 | 874,177 |
| 2009 | 32,440,094 | 832,398 |

| Year | Total Enplaned Passengers | Total Passenger Aircraft Operations |
|---|---|---|
| 2010 | 32,963,479 | 864,286 |
| 2011 | 32,980,669 | 875,138 |
| 2012 | 33,242,124 | 870,956 |
| 2013 | 33,402,530 | 870,228 |
| 2014 | 35,136,941 | 872,179 |
| 2015 | 37,317,207 | 871,583 |
| 2016 | 38,785,696 | 862,187 |
| 2017 | 39,826,556 | 862,030 |
| 2018 | 41,623,010 | 877,461 |
| Forecast | | |
| 2019 | 43,560,290 | 912,737 |
| 2020 | 44,620,281 | 914,029 |
| 2021 | 45,583,343 | 915,044 |
| 2022 | 46,494,099 | 916,379 |
| 2023 | 47,370,842 | 918,075 |
| 2024 | 48,212,837 | 924,654 |
| 2025 | 49,053,364 | 931,555 |
| 2026 | 49,900,388 | 939,218 |
| 2027 | 50,779,408 | 947,240 |
| 2028 | 51,696,340 | 955,702 |
| 2029 | 52,646,798 | 964,531 |
| 2030 | 53,625,042 | 973,592 |
| Compound Annual Growth Rate | | |
| 2006-18 | 0.7% | -0.5% |
| 2018-30 | 2.1% | 0.9% |

Sources: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020; FAA 2018 Terminal Area Forecast

The adjusted aircraft operations forecast was developed after analyzing the future fleet mix, average seats per departure, and average load factors. The CDA's proposed fleet mix is shown in Exhibit 3-2 on page 11 of their report, which can be found in **Attachment B-2**, and in **Figure B-27** below.

## FIGURE B-27
## PROPOSED PASSENGER AIRLINE FLEET MIX




Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

It is the view of the FAA's Third Party Consultant that while the average aircraft size (seats/operation) is rising quite quickly (from 111.9 in 2018 to 128.6 in 2030), it is consistent with the 2013-18 span in which seats/operation increased from 94.0 to 111.9.

The results of CDA's assumptions regarding the representation of average aircraft types by seat capacity band, along with average occupancy factors, drive the results presented in Table 3-5 of the CDA report, which can be found in **Attachment B-2** as well as in **Table B-8**.

## TABLE B-8
## PASSENGER AIRCRAFT OPERATIONS ASSUMPTIONS – CALENDAR YEARS

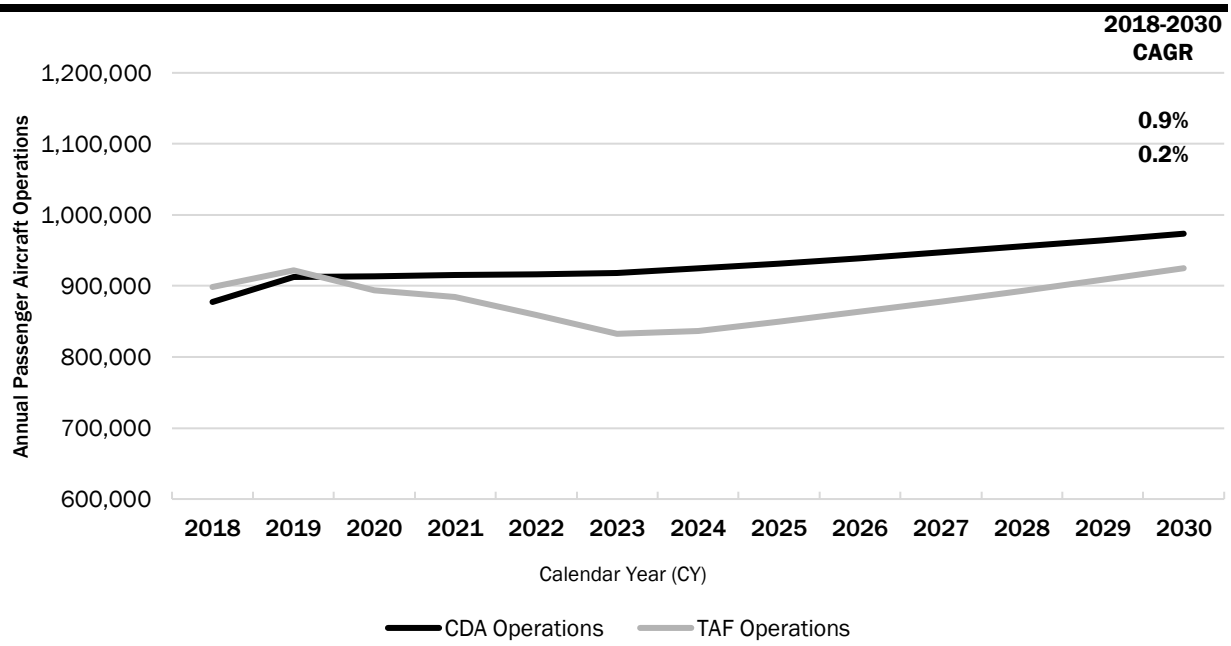
| Year | Total Passenger Aircraft Operations | Average Seats per Departure | Total Enplaned Passengers | Average Seat Factor |
|---|---|---|---|---|
| **Historical** | | | | |
| 2006 | 932,874 | 104.2 | 38,122,240 | 78.4% |
| 2007 | 913,945 | 104.6 | 37,402,803 | 78.2% |
| 2008 | 874,177 | 104.3 | 34,890,004 | 76.5% |
| 2009 | 832,398 | 102.7 | 32,440,094 | 75.9% |
| 2010 | 864,286 | 96.7 | 32,963,479 | 78.9% |
| 2011 | 875,138 | 95.9 | 32,980,669 | 78.6% |
| 2012 | 870,956 | 95.1 | 33,242,124 | 80.3% |
| 2013 | 870,228 | 94.0 | 33,402,530 | 81.7% |
| 2014 | 872,179 | 97.0 | 35,136,941 | 83.1% |
| 2015 | 871,583 | 104.6 | 37,317,207 | 81.9% |
| 2016 | 862,187 | 109.2 | 38,785,696 | 82.4% |
| 2017 | 862,030 | 113.0 | 39,826,556 | 81.8% |
| 2018 | 877,461 | 111.9 | 41,623,010 | 84.8% |
| **Forecast** | | | | |
| 2019 | 912,737 | 112.3 | 43,560,290 | 85.0% |
| 2020 | 914,029 | 114.9 | 44,620,281 | 85.0% |
| 2021 | 915,044 | 117.1 | 45,583,343 | 85.1% |
| 2022 | 916,379 | 119.2 | 46,494,099 | 85.1% |
| 2023 | 918,075 | 121.2 | 47,370,842 | 85.1% |
| 2024 | 924,654 | 122.2 | 48,212,837 | 85.3% |
| 2025 | 931,555 | 123.2 | 49,053,364 | 85.5% |
| 2026 | 939,218 | 124.2 | 49,900,388 | 85.6% |
| 2027 | 947,240 | 125.2 | 50,779,408 | 85.6% |
| 2028 | 955,702 | 126.2 | 51,696,340 | 85.7% |
| 2029 | 964,531 | 127.2 | 52,646,798 | 85.7% |
| 2030 | 973,592 | 128.6 | 53,625,042 | 85.7% |
| **Compound Annual Growth Rate** | | | | |
| 2006-2018 | -0.5% | | 0.7% | |
| 2018-2030 | 0.9% | | 2.1% | |

Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

These factors were then applied to the TAF passenger forecast. The FAA's Third Party Consultant views these assumptions, and the passenger operations forecast, as reasonable. **Figure B-28** shows a comparison

of CDA's passenger operations forecast and the TAF. The CDA projects passenger operations will grow at an average annual rate of 0.9 percent between 2018 and 2030, while the TAF assumed an average annual growth rate of 0.2 percent over the same period.

## FIGURE B-28
## CDA PASSENGER AIRCRAFT OPERATIONS FORECAST VS FAA TAF




Note: TAF operations include Air Carrier and Air Taxi operations. The TAF is converted from federal fiscal years to calendar years.
Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

### B.6.2 Cargo Operations Forecast

Since 2014, cargo operations at Chicago have seen a steady increase. With new cargo facilities at O'Hare, the airport can process additional cargo. Unlike passenger operations, cargo activity peaks during the winter months, as well as during the nighttime hours.

The CDA developed cargo operations forecasts based on O'Hare's share of the FAA's forecast of U.S. cargo activity. The CDA confirmed that the FAA's cargo forecast for the U.S. is reasonable in that it links cargo to economic activity in the U.S. The CDA then made assumptions about average aircraft size, load, and routes to derive cargo operations at O'Hare. The FAA's Third Party Consultant has reviewed the methodology and results and finds them reasonable and appropriate for environmental modeling.

### B.6.3 General Aviation and Military Operations Forecast

Both general aviation and military operations make up a small share of total operations at O'Hare, accounting for 0.6 percent of total operations are the airport. As a result, the CDA assumed the TAF was a sufficient forecast of future operations. The FAA's Third Party Consultant agrees with this approach.

### B.6.4 Aircraft Operations Forecast Conclusions

Based on the CDA's analysis of aircraft operation trends at Chicago, both historically and in the future, and the FAA's Third Party Consultant's independent analysis, the adjusted aircraft operations forecast is reasonable.

## B.7 DESIGN DAY FLIGHT SCHEDULE ANALYSIS

From the annual forecasts of passengers and aircraft operations, the CDA derived forecasts of peak period activity to develop design day flight schedules for 2023 and 2030 that provide the basis and detail for environmental modeling. Peak period scheduled passenger airline activity in summer 2019 provided the basis for the passenger and passenger aircraft activity. For non-scheduled activity including cargo, general aviation, and military activity, a variety of data sources collected by the U.S. Department of Transportation (DOT) and the City for activity in 2018 were used to form a base schedule of activity by those airport users. The CDA then applied the expected annual growth rates discussed in the previous section to passenger, cargo, general aviation, and military activity to develop design day flight schedules that reflect the amount, time of day, and expected aircraft in 2023 and 2030. The FAA's Third Party Consultant has reviewed the source data, analytical methodology, modeling, and results, and believes that the resultant design day flight schedules are appropriate for environmental modeling purposes.

### B.7.1 Baseline Peak Month Average Day

The CDA developed design day flight schedules based on peak month average day activity at O'Hare, which is appropriate for environmental modeling purposes because it reflects typical activity during the busiest period of the year. Using activity from the busiest time of the year translates to the highest sustained period of noise and emissions generation and, therefore, effects on the environment. Activity at O'Hare peaks in the summer and the peak has historically occurred in July.

#### B.7.1.1 Passenger Aircraft Activity

During July, passenger airlines schedule the most flights and have the most seat capacity available of any month of the year. Passenger airline schedules typically include a similar number of flights each weekday, with lower levels of activity on weekends or during holiday weeks such as the week that contains Independence Day, July 4. Published schedules for passenger airline activity throughout 2019 reflect a peak in July and exhibit the typical pattern of peak activity during weekdays. The CDA has selected a weekday outside of a holiday week, all of which have virtually identical schedules in July of 2019. The specific day selected was Wednesday, July 24, 2019. The flight schedule from the selected day provides all the detail of each flight, including arrival and departure times, airline operator, route, and aircraft type. The FAA's Third Party Consultant believes the CDA's approach and its selection of a base design day for passenger activity is reasonable and appropriate for environmental evaluation.

#### B.7.1.2 Non-Passenger Aircraft Activity

All cargo, general aviation, and military activity was based on actual activity at O'Hare in the peak month of 2018 (July). The CDA used a variety of sources to develop a base schedule of activity for these operations. These sources included the FAA's Air Traffic Activity Data Systems (ATADS), the FAA's Traffic Flow Management System Counts (TFMSC), and Aerobahn noise monitoring data along with the CDA's own statistics as published on its website. By using available information from each of these sources, the CDA

developed a representative schedule of cargo, general aviation, and military activity that includes arrival and departure times, the operator of the flight, routing, and aircraft type. This schedule provides the same level of detail as published schedules for passenger activity.

While general aviation and military activity are relatively consistent over the course of the year, cargo aircraft activity peaks in the fall and winter. Cargo activity seasonality peaks are driven by increased consumer activity leading up to the holidays toward the end of the calendar year. At O'Hare, cargo operations typically peak in October or November; in 2018 the cargo operations peak occurred in October. To ensure that cargo operations were not under-represented in a design day schedule from July, the CDA reviewed cargo activity from October 2018 and found that the amount of cargo activity at night was not under-represented in aircraft types or operations in the July schedules.

For this reason, the CDA has proceeded with an unadjusted July peak for cargo, general aviation, and military activity. The FAA's Third Party Consultant has reviewed the CDA's data sources, analysis, reasoning, and conclusions, and believes that the July design day flight schedule for cargo, general aviation, and military activity based on 2018 data is reasonable and appropriate for environmental modeling purposes for this EA.

#### B.7.1.3 Passenger Activity

The CDA developed peak month average day passenger activity by applying load factors and origin and destination versus connecting passengers on a flight-by-flight basis using historical data from 2018. Passenger load factors were sourced from the U.S. Department of Transportation T-100 data base by airline and city pair market; origin and destination passengers were sourced by airline and route from the U.S. Department of Transportation Origin and Destination Passenger Survey. The FAA's Third Party Consultant believes this is reasonable and appropriate.

### B.7.2 Peak Period Passenger Activity Forecasts

Over the forecast period, the CDA applied annual forecast growth rates to passengers on a flight-by-flight basis. As load factors on existing aircraft reached operational limits (95 percent), the CDA increased the size of aircraft to the next largest variant of the aircraft group. In addition, the CDA phased out certain aircraft types over the forecast period to reflect aircraft replacement strategies of the various airlines. Consistent with these aircraft replacement plans, the new aircraft is typically larger than the old aircraft it replaced.

Once up-gauging and aircraft replacement opportunities were exhausted, the CDA added flights in the city-pair market. New flights were added proportionally across the day to preserve the peaks and troughs (or waves) of flights typical of O'Hare. New flights also preserved the day-night split of activity, and the relative market shares of the airlines, so as not to change the character of passenger air service at O'Hare. The FAA's Third Party Consultant believes the CDA's analysis and conclusions in developing the design day flight schedules for passenger activity are reasonable and appropriate.

### B.7.3 Peak Period Non-Passenger Activity Forecasts

For cargo, general aviation, and military activity, the CDA applied annual forecast growth rates to aircraft operations. As additional operations were appropriate, the CDA added flights to the design day flight schedule that preserved the timing and character of the operations over the course of the day as well as the proportion of operations operated during the day and night. The FAA's Third Party Consultant believes

that the CDA's analysis and conclusions in developing the design day flight schedules for cargo, general aviation, and military activity is reasonable and appropriate.

### B.7.4 Daytime and Nighttime Aircraft Activity

In developing the design day flight schedules, the CDA included the typical share of nighttime aircraft activity at O'Hare between 10:00:00 PM and 06:59:59 AM. As described above, passenger operations were added proportionally across the day in a manner that preserves the hourly profile of flight activity over the course of the day and the night. Additional cargo flights were added in proportion to the day and night split of such activity. While general aviation activity overwhelmingly occurs during the day, the design day flight schedules include general aviation activity at night to ensure appropriate representation.

Historically, nighttime activity at O'Hare has represented approximately 10 percent of total activity at the Airport. In 2019, nighttime activity represented 10.4 percent of total activity during the peak month average day. In the CDA's 2023 design day flight schedule, nighttime activity represents 10.5 percent of total activity, while in the CDA's 2030 design day flight schedule, nighttime activity represents 10.6 percent of total activity. The FAA's Third Party Consultant believes the CDA's design day flight schedule activity in the daytime and the nighttime are reasonable and appropriate for environmental modeling.

# ATTACHMENT B-1

# ANALYSIS OF THE IMPACT OF PROJECT DELAYS ON THE FORECAST OF PASSENGER ACTIVITY

The construction schedule for the Proposed Action has been revised to commence in Fall 2022 at the earliest, compared to the original scheduled construction start in Spring 2021. This change is due to project-related delays. As a result of revisions to the proposed construction schedule, the FAA asked its Third Party Consultant to analyze the forecasts of the Interim Condition and Build Out Condition to determine whether they remain appropriate for environmental modeling. This memorandum does not address the impact COVID-19 has had on forecast operations at O'Hare. The impact of COVID-19 is addressed in **Appendix N**. The analysis found that while COVID-19 had an immediate and significant impact on O'Hare's passenger traffic and operations, O'Hare will resume growth and is expected to achieve previously forecasted traffic levels for 2030 by 2032.

The original forecast period used to assess the environmental effects of the Proposed Action was 2019–30, with specific design days analyzed for the Interim Condition in 2023, representing a peak construction year, and 2030, reflecting full Build Out. As a result of the revised timetable, the forecast year representing peak construction conditions analyzed in the Interim year would shift from 2023 to 2025 and Build Out would shift from 2030 to 2032. While the proposed construction schedule remains subject to further review, the FAA's Third Party Consultant re-examined the differences in passenger operations, passenger fleet mix, and total aircraft operations from 2023 and 2030 to 2025 and 2032. The following analysis demonstrates that differences in fleet mix and operations are not material and that there would not be significant changes to the forecast if the analysis years are shifted.

**Table B-1-1** shows the passenger operations forecasted by the City of Chicago for O'Hare between 2018 and 2030. As shown, passenger operations are forecast to increase 0.7 percent year-over-year between 2023 and 2025, which equates to an increase of 37 daily operations over the two-year period. In its forecast, the City of Chicago's aircraft operations forecast exceeded that of the FAA's TAF because the TAF assumed a complete retirement of 50-seat regional jets in 2023. These additional aircraft operations made the 2023 Interim Condition forecast conservative. Because the difference in operations between 2023 and 2025 is modest, and the original forecast of operations was conservatively above the TAF, the forecast Interim Condition in 2023 remains relevant for 2025. Furthermore, the results of Total Airspace and Airport Modeler (TAAM) modeling of activity levels in 2023 and 2030 did not trigger delays under a no-action scenario and all flights could be gated (see No Action Build Out gate schedule from TAAM modeling in **Attachment B-2**), which provides further basis for reasoning that a two-year delay in the Interim Condition would have no material impact on results.

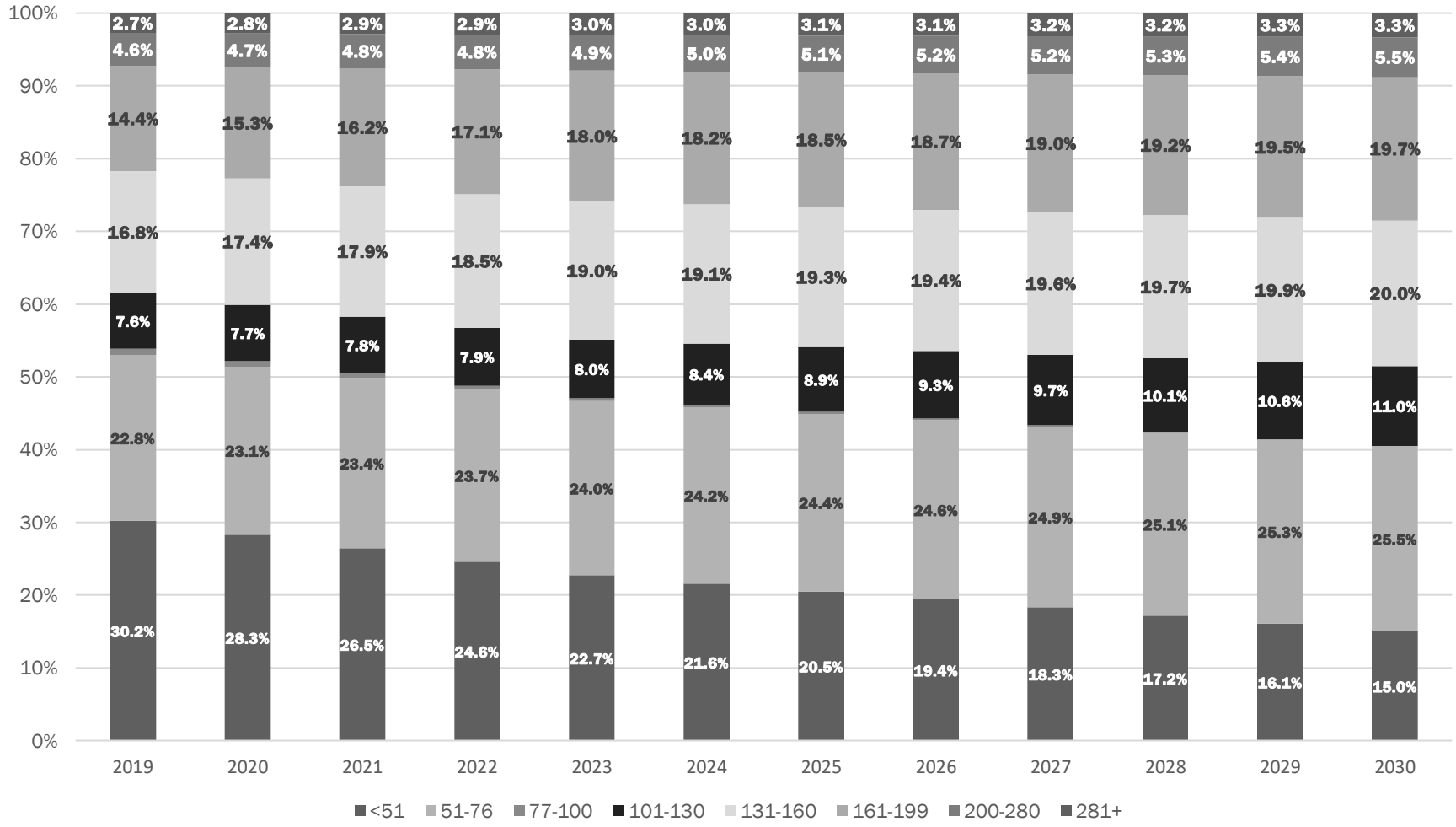
Passenger operations between 2028 and 2030 are forecast to increase 0.9 percent year-over-year, or by 25 daily operations in 2029 and an additional 24 daily operations in 2030, for a total increase of 49 daily operations over the two-year span. The increase in operations between 2028 and 2030 is similar to the expected increase in the operations forecast in 2031 and 2032. These modest increases in activity would not give rise to significant changes to environmental analysis, and therefore the level of activity analyzed for Build Out in 2030 would remain appropriate for 2032.

# TABLE B-1-1
# FORECAST OF PASSENGER OPERATIONS AT O'HARE

| Year | Passenger Operations | Percent Change | Average Daily Operations |
|---|---|---|---|
| 2018 | 877,461 | | 2,404 |
| 2019 | 912,737 | 4.0% | 2,501 |
| 2020 | 914,029 | 0.1% | 2,504 |
| 2021 | 915,044 | 0.1% | 2,507 |
| 2022 | 916,379 | 0.1% | 2,511 |
| 2023 | 918,075 | 0.2% | 2,515 |
| 2024 | 924,654 | 0.7% | 2,533 |
| 2025 | 931,555 | 0.7% | 2,552 |
| 2026 | 939,218 | 0.8% | 2,573 |
| 2027 | 947,240 | 0.9% | 2,595 |
| 2028 | 955,702 | 0.9% | 2,618 |
| 2029 | 964,531 | 0.9% | 2,643 |
| 2030 | 973,592 | 0.9% | 2,667 |

Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

## FIGURE B-1-1
## FORECAST OF FLEET MIX FOR O'HARE PASSENGER OPERATIONS




Note: The share of aircraft operations in the 77-100 category represents less than half a percent throughout the 2023-2030 time period.
Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

The FAA's Third Party Consultant also analyzed the passenger fleet mix that the City forecasted for the years between 2023 and 2030 to assess any significant changes in the passenger aircraft utilized at O'Hare. Based on the fleet forecast that the City provided for 2019, 2023, and 2030, the FAA's Third Party Consultant interpolated the results for 2020–22 and 2024–29. As shown in **Figure B-1-1**, the FAA's Third Party Consultant found no material changes to the passenger fleet mix expected to operate at O'Hare as the significant fleet changes such as the elimination of MD-88 and MD-90 aircraft were forecast to occur prior to 2023, with only incremental changes because of fleet modernization occurring thereafter. The minimal changes in the forecasted fleet mix through 2030 reinforces the analysis that shifting the analysis years to include 2031 and 2032 would not meaningfully impact the forecast of operations or fleet mix.

As shown in **Table B-1-2**, total aircraft operations were analyzed by operation type for the same period between 2023 and 2025 and between 2028 and 2030. Over the life of the forecast, O'Hare's operations are forecast to increase at approximately one percent per year. As discussed earlier, passenger operations are projected to increase at 0.7 percent per year between 2023 and 2025 and 0.9 percent per year between 2028 and 2030. General aviation and military operations are forecasted to remain constant throughout the forecast period and are not expected to change beyond 2030. Cargo operations are forecast to increase at the highest rate of 2.8 percent over the forecast period of 2018–30. However, cargo operations remain a small portion of total operations; they account for approximately three percent of total flights at O'Hare throughout the forecast period, and changes between the years of 2023 and 2025, and 2030 and beyond would not be significant to the overall forecast.

## TABLE B-1-2
## TOTAL AIRCRAFT OPERATIONS FORECAST FOR O'HARE

| Total Aircraft Operations Forecast | | | | | |
|---|---|---|---|---|---|
| **Year** | **Passenger** | **Cargo** | **General Aviation** | **Military** | **Total** |
| 2018 | 877,461 | 24,739 | 5,770 | 75 | 908,045 |
| 2019 | 912,737 | 25,878 | 5,906 | 75 | 944,596 |
| 2020 | 914,029 | 26,704 | 5,906 | 75 | 946,714 |
| 2021 | 915,044 | 27,361 | 5,906 | 75 | 948,386 |
| 2022 | 916,379 | 27,937 | 5,906 | 75 | 950,297 |
| 2023 | 918,075 | 28,433 | 5,906 | 75 | 952,489 |
| 2024 | 924,654 | 28,994 | 5,906 | 75 | 959,629 |
| 2025 | 931,555 | 29,718 | 5,906 | 75 | 967,254 |
| 2026 | 939,218 | 30,572 | 5,906 | 75 | 975,771 |
| 2027 | 947,240 | 31,485 | 5,906 | 75 | 984,706 |
| 2028 | 955,702 | 32,410 | 5,906 | 75 | 994,093 |
| 2029 | 964,531 | 33,360 | 5,906 | 75 | 1,003,872 |
| 2030 | 973,592 | 34,283 | 5,906 | 75 | 1,013,856 |
| Compound Annual Growth Rate | | | | | |
| **2018–30** | 0.9% | 2.8% | 0.2% | 0.0% | 0.9% |
| **2023–25** | 0.7% | 2.2% | 0.0% | 0.0% | 0.8% |

| | | | | | |
|---|---|---|---|---|---|
| **2028–30** | 0.9% | 2.8% | 0.0% | 0.0% | 1.0% |

Source: Chicago Department of Aviation Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast; January 24, 2020

In conclusion, the FAA's Third Party Consultant found that changes in passenger operations, the passenger fleet mix and total aircraft operations between 2023–25 and 2028–30 were not significant and therefore shifting the analysis years for the Interim Condition to 2025 and the Build Out Condition to 2032 would not meaningfully impact the forecast.

# ATTACHMENT B-2

# CHICAGO DEPARTMENT OF AVIATION'S TERMINAL AREA PLAN AND AIR TRAFFIC ACTIONS

# ENVIRONMENTAL ASSESSMENT ANNUAL ACTIVITY FORECAST


TERMINAL AREA PLAN

# Terminal Area Plan and Air Traffic Actions Environmental Assessment Annual Activity Forecast


PREPARED BY:
RICONDO & ASSOCIATES, INC.

January 24, 2020
DRAFT

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## List of Appendices



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## List of Exhibits

# 1. Introduction

This document presents information on annual activity forecasts (passenger airline, cargo airline, general aviation, and military) at Chicago O'Hare International Airport (O'Hare or the Airport) for use in the Terminal Area Plan and Air Traffic Actions Environmental Assessment (TAP EA). The TAP EA is evaluating the addition of facilities and various airspace changes at O'Hare. The Airport plays a critical role in the national airport system serving as one of the busiest airports in the U.S. It services the fourth largest population base in the country and serves as a connecting hub for United Airlines (United) and American Airlines (American). The Federal Aviation Administration's *2018 Terminal Area Forecast* (TAF) provides a forecast of airport activity unconstrained by facility development that reflects continued growth. This memo evaluates the use of the FAA's TAF as the forecast of passenger growth and includes various factors that could influence deviations from the TAF forecast. This includes factors such as:

- An understanding of recent and upcoming terminal facility development
- The potential influence of the terminal facility projects, or lack thereof, on activity forecasts
- Potential constraints of a no-action scenario, a description of the TAP project phasing, and a constrained schedule analysis.

As discussed herein, the analyses support the use of the passenger activity forecast included in the TAF. A modified version of the TAF aircraft operations is being proposed in order to address airport-specific considerations. While there are many factors that could influence future activity levels, some materially, the FAA TAF activity levels reflect a reasonable assumption of activity for purposes of the EA.

# 2. Background

The passenger and operational forecast analysis discussed in this memo includes consideration of potential historical and future constraints and their impact to historical or forecast activity levels.

## 2.1 Role of the Airport

The airport serves Origin and Destination (O&D) passengers to and from the Chicago area. Population, personal income, and other economic factors are strong indicators of passenger demand. The Chicago 15-county Air Trade Area (ATA) includes a large population and robust personal income. The ATA is the fourth most populous metropolitan region in the U.S. and the per capita personal income is 10.4 percent higher than that of the U.S. in 2017.

The large economic base and central geographic location make it a natural location for an airline hub. O'Hare serves as an international connecting hub for United and American. It is the busiest airport in United's system measured in terms of passengers and the fourth busiest airport in American's network.

## 2.2 Flight Limitations

O'Hare has historically been under restricted flight operations in various forms. The "High Density Rule" established in 1969 to manage congestion at five high-density airports. Following the phasing out of the High Density Rule which was completed in 2002, the Airport experienced the first unconstrained operational activity in several decades. The operational activity increased, and significant delays occurred. Flight caps were imposed starting in 2004 to address these delays. In 2005, construction of the O'Hare Modernization Program (OMP) began, which implemented an airfield program designed to reduce delays and increase airfield capacity. The flight caps expired in 2008 in conjunction with the completion of the first OMP runway project. The period from 2008 through present reflects activity not constrained by FAA imposed flight restrictions and can be used to inform analysis of future activity at the airport.

The OMP airfield projects include a comprehensive reconfiguration of the airfield from sets of converging parallel runways in three main directional orientations (northeast/southwest, east/west, and northwest/southeast) to six parallel runways in the east/west direction and two crosswind runways in the northeast/southwest direction. The first component, Runway 9L/27R, was completed and opened in 2008. The relocation of two runways and extension of two additional runways are complete and the final new runway and runway extension are anticipated to be completed in 2020 and 2021 respectively.

The increase in flights following the phasing out of the High Density Rule occurred during a period of economic growth. Also, during this time, airlines were retiring older narrow body aircraft, such as the Boeing 737 Classics and MD-80s and increasing the use of regional jet aircraft. These factors are reflected in the growth of aircraft operations at O'Hare, which led to delays that ultimately resulted in the FAA's implementation of flight caps. The period immediately following the flight caps included an economic recession. As the economy recovered from the recession, operational activity growth was limited while airlines implemented capacity discipline throughout the industry, retired smaller regional jets, and upgauged aircraft throughout airline fleets. These factors resulted in stagnant aircraft operations growth until recently.

While operations are returning to levels that occurred when flight caps were implemented, the OMP airfield projects enhanced the capacity of the airport and improved the operational performance. As evidence, the average hourly arrival throughput rates have increased approximately 20 percent the minutes of FAA system impact delays attributed to O'Hare have been reduced by approximately 63 percent when comparing the six years prior to the OMP (2003–2008) to the period since the OMP began (2009–2018).[1] While it is possible for the FAA to implement measure to regulate flights, the evaluation would be based on airport performance (i.e. delays) and not an operational level without consideration of delays.

[1] Source: FAA Aviation System Performance Metrics (System Impact Delays), May 2019; Ricondo & Associates, Inc. (calculations); May 2019. System Impact Delays are delays assigned to causal facilities in FAA's operations network and composed of traffic management initiatives delays, departure delays, and airborne delays.

## 2.3 Terminal Facility Development

The City of Chicago has begun terminal facility development with most of the OMP runway projects now complete or under construction. As of April 2017, there were 185 gates at O'Hare.[2] The L-concourse stinger expansion in 2018 was the first terminal project, adding 535 linear feet of gate frontage and five additional gate positions. Near-term gate projects are included in the No Action scenario of the TAP EA. These include an additional L-concourse stinger expansion and the terminal extension which are collectively anticipated to result in an additional 1,827 feet and 10-16 gates depending on the configuration. The TAP project is anticipated to include approximately 3,858 linear feet of increment frontage and up to 219 total gates depending on the configuration. The gate facility projects are discussed in more detail in Section 6.

# 3. Annual Activity Forecasts

As reflected herein, the Federal Aviation Administration's *2018 Terminal Area Forecast* (TAF), published in March 2019 is proposed as the primary source of the forecast used in the TAP EA. The various components of the TAF were assessed to determine their reasonableness to serve as the basis for analyses supporting the TAP EA. Specifically, the enplaned passenger forecast and passenger, cargo, general aviation, and military aircraft operations forecasts were each separately evaluated to determine whether to adopt them as published in the TAF, or whether adjustments were necessary. The following sections summarize the process used to confirm the appropriateness of the TAF for the TAP EA, and any adjustments made to better reflect anticipated O'Hare activity.

## 3.1 Passenger Airline Activity

### 3.1.1 Enplaned Passenger Forecasts

The TAF was reviewed for adoption as the annual enplaned passenger forecast. The TAF is prepared by the FAA using a combination of methodologies including review of recent industry trends and expectations of future airline service and schedule data to inform near-term forecasts, and statistical analysis of the relationship between historical demand and local and national economic conditions to inform longer-term forecasts. Per the FAA, the TAF assumes a demand driven forecast for aviation services based upon local and national economic conditions, as well as conditions within the aviation industry and is developed independent of the ability of the airport and air traffic control system to furnish the capacity required to meet demand.

Certain adjustments and assumptions were made in order to provide a complete forecast that is directly comparable to annual demand anticipated to be used for the TAP EA. The TAF is published using federal fiscal years (October-September). Therefore, it was converted to calendar year for the purposes of this analysis using US DOT Form T-100 data (from December 2017 through November 2018) to apportion

[2] For purposes of this memo a gate is an active aircraft parking position that is accessed through the terminal building, either via a passenger loading bridge or other means. The number of gates is subject to change based on the configuration of aircraft parking.

passengers by month in the calendar year based on actual passengers over that time period. **Table 3-1** presents the 2018 TAF in Federal fiscal years and calendar years.

**TABLE 3-1: 2018 TERMINAL AREA FORECAST – FISCAL AND CALENDAR YEARS**

| Year | 2018 TAF (Fiscal Years) | 2018 TAF (Calendar Years) |
|---|---|---|
| **Historical** | | |
| 2006 | 36,969,264 | 36,913,006 |
| 2007 | 36,742,947 | 36,217,744 |
| 2008 | 34,630,139 | 33,786,366 |
| 2009 | 31,235,776 | 31,412,704 |
| 2010 | 31,947,531 | 31,917,226 |
| 2011 | 31,825,619 | 31,932,654 |
| 2012 | 32,256,202 | 32,185,877 |
| 2013 | 31,973,296 | 32,342,340 |
| 2014 | 33,457,901 | 34,021,847 |
| 2015 | 35,726,566 | 36,130,416 |
| 2016 | 37,351,189 | 37,554,536 |
| 2017 | 38,169,220 | 38,568,476 |
| 2018[1] | 39,775,365 | 40,309,141 |
| **Forecast** | | |
| 2019 | 41,922,662 | 42,184,491 |
| 2020 | 42,975,959 | 43,211,552 |
| 2021 | 43,923,714 | 44,144,993 |
| 2022 | 44,813,884 | 45,027,930 |
| 2023 | 45,674,957 | 45,878,026 |
| 2024 | 46,491,870 | 46,694,565 |
| 2025 | 47,307,278 | 47,509,690 |
| 2026 | 48,121,550 | 48,331,092 |
| 2027 | 48,964,505 | 49,183,402 |
| 2028 | 49,845,092 | 50,072,333 |
| 2029 | 50,759,245 | 50,993,653 |
| 2030 | 51,702,230 | 51,941,815 |
| **Compound Annual Growth Rate** | | |
| 2006-2018 | 0.6% | 0.7% |
| 2009-2018 | 2.7% | 2.8% |
| 2018-2030 | 2.2% | 2.1% |

NOTE: Excludes nonrevenue passengers.

1 2018 values in the TAF are forecast.

SOURCE: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019.

While the TAF forecasts passengers by individual market pair, it does not present forecasts of origin and destination (O&D) and connecting passengers separately. As a hub for United and American, O'Hare serves both O&D and connecting passengers, and the airlines are able to adjust the share of each type that they accommodate at ORD. In recent years, the share of O&D passengers has grown at O'Hare as new nonstop flying by both hub and non-hub carriers has increased. For the purposes of these analyses, and consistent with the assumptions used by the FAA in the development of the TAF, this share is assumed to remain stable during the forecast period, although this share could change in the future.

Additionally, the TAF reflects revenue passengers only. Therefore, the TAF was further adjusted to include nonrevenue passengers[3], providing a more complete representation of traffic at the Airport. Chicago Department of Aviation data indicate that an additional 3.5 percent of domestic passengers, and 1.8 percent of international passengers were served on a nonrevenue basis in 2018.

The 2018 TAF, converted to calendar years and adjusted for nonrevenue passengers, is presented in **Table 3-2**. Enplaned passengers grew from 2006, the peak year of passenger activity prior to 2016, to CY 2018 at a compound annual growth rate of 0.7 percent. For comparison, the growth rate between CY 2009, the recent low of O'Hare passenger activity, and CY 2018 was 2.9 percent compounded annually. This growth reflects recovery from the 2008 recession.

As shown in Table 2, enplaned passenger volumes are forecast to grow from approximately 41.6 million in CY 2018 to 53.6 million in CY 2030, a compound annual growth rate of 2.1 percent. The 2018 TAF projected 40.3 million revenue enplaned passengers at O'Hare in CY 2018. According to U.S. DOT T-100 data[4], the actual number of total enplaned passengers was 40.0 million.

The reasonableness of the passenger forecast in the TAF was also assessed through an analysis of the relationship between historical total passenger demand and local and national socioeconomic statistics. Single variable regression analysis was used to determine the predictive relationship between a dependent variable (passenger volume) and an independent demographic and economic variable, including earnings, employment, gross regional/domestic product, population, personal income, and personal income per capita for the Chicago-Naperville CSA and the United States since 2009. The year 2009 was selected as it represents the first full year of activity after the FAA removed flight caps at the Airport in October 2008.

These relationships, in the form of an equation, were used with independent forecasts of socioeconomic activity to project passenger volumes through 2030. The coefficient of determination, or r-squared, for each of these relationships, and the 2018-2030 predicted passenger compound annual growth rates are presented in **Table 3-3**. The 2018 TAF growth rate is also shown for purposes of comparison.

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[3] Nonrevenue passengers are crew members and other airline employees or their family members or designees travelling without a purchased ticket.

[4] Accessed from Diio Mi, July 2019

The growth rate of total enplaned passengers is generally in-line with the socioeconomic-derived growth rates and, as shown on Table 3, higher than the average growth rate of the identified relationships, and equal to the highest growth rate observed.

**TABLE 3-2: ENPLANED PASSENGER FORECAST**

| Calendar Year | Domestic Enplaned Passengers | International Enplaned Passengers | Total Enplaned Passengers |
|---|---|---|---|
| **Historical** | | | |
| 2006 | 32,734,360 | 5,387,880 | 38,122,240 |
| 2007 | 32,040,915 | 5,361,887 | 37,402,803 |
| 2008 | 29,783,283 | 5,106,721 | 34,890,004 |
| 2009 | 27,753,594 | 4,686,500 | 32,440,094 |
| 2010 | 28,344,394 | 4,619,085 | 32,963,479 |
| 2011 | 28,431,477 | 4,549,192 | 32,980,669 |
| 2012 | 28,654,893 | 4,587,231 | 33,242,124 |
| 2013 | 28,715,964 | 4,686,566 | 33,402,530 |
| 2014 | 30,195,419 | 4,941,522 | 35,136,941 |
| 2015 | 32,225,132 | 5,092,075 | 37,317,207 |
| 2016 | 33,353,966 | 5,431,730 | 38,785,696 |
| 2017 | 33,872,060 | 5,954,497 | 39,826,556 |
| 2018[1] | 35,339,515 | 6,283,495 | 41,623,010 |
| **Forecast** | | | |
| 2019 | 37,036,425 | 6,523,866 | 43,560,290 |
| 2020 | 37,904,594 | 6,715,687 | 44,620,281 |
| 2021 | 38,675,123 | 6,908,220 | 45,583,343 |
| 2022 | 39,391,826 | 7,102,273 | 46,494,099 |
| 2023 | 40,073,734 | 7,297,109 | 47,370,842 |
| 2024 | 40,720,194 | 7,492,643 | 48,212,837 |
| 2025 | 41,364,862 | 7,688,502 | 49,053,364 |
| 2026 | 42,015,906 | 7,884,482 | 49,900,388 |
| 2027 | 42,698,941 | 8,080,467 | 50,779,408 |
| 2028 | 43,419,833 | 8,276,506 | 51,696,340 |
| 2029 | 44,174,116 | 8,472,683 | 52,646,798 |
| 2030 | 44,956,023 | 8,669,019 | 53,625,042 |
| **Compound Annual Growth Rate** | | | |
| 2006-2018 | 0.6% | 1.3% | 0.7% |
| 2009-2018 | 2.7% | 3.3% | 2.8% |
| 2018-2030 | 2.0% | 2.7% | 2.1% |

NOTE: The values depicted in this table have been converted from Federal fiscal year to calendar year and adjusted for nonrevenue passengers.

1 2018 values in the TAF are forecast.

SOURCE: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019.

TABLE 3-3: COMPARISON OF SOCIOECONOMIC MODEL OUTPUTS

| Socioeconomic Variable | R-Squared Value | 2018-2030 Predicted Passenger CAGR |
|---|---|---|
| United States-Total Personal Income | 91.7% | 2.1% |
| **2018 TAF** | **NA** | **2.1%** |
| Time Series | 88.6% | 2.0% |
| United States-Gross Regional Product | 93.8% | 2.0% |
| United States-Total Population | 88.8% | 2.0% |
| United States-Total Earnings | 91.2% | 1.9% |
| United States-Total Personal Income Per Capita | 91.3% | 1.8% |
| Chicago-Naperville, IL-IN-WI-Gross Regional Product | 90.7% | 1.8% |
| United States-Total Employment | 91.5% | 1.7% |
| Chicago-Naperville, IL-IN-WI-Total Personal Income | 89.7% | 1.7% |
| Chicago-Naperville, IL-IN-WI-Total Employment | 91.5% | 1.6% |
| Chicago-Naperville, IL-IN-WI-Total Earnings | 87.0% | 1.5% |
| Chicago-Naperville, IL-IN-WI-Total Personal Income Per Capita | 91.2% | 1.4% |
| **Average** | **NA** | **1.8%** |

SOURCES: Federal Aviation Administration *2018 Terminal Area Forecast*, March 2019; US DOT Form T-100 (historical), date accessed June 2019; Woods & Poole Economics, Inc., June 2019; Ricondo & Associates, Inc. (analysis), June 2019.

A market share analysis was also conducted to determine ORD's enplaned passenger volumes relative to the US, presented in **Table 3-4**.

ORD's share of total US enplaned passengers has remained stable at between 4.4 and 4.5 percent since 2009. Based on the 2018 TAF converted to calendar year, O'Hare is forecast to grow at a similar rate as the US and maintain a 4.5 percent share of US enplaned passengers throughout the forecast period.

### 3.1.2 Passenger Airline Operations Forecasts

The 2018 TAF operations forecast was considered for use in the TAP EA analysis. The 2018 TAF aircraft operations forecast is presented in **Exhibit 3-1**. The TAF forecasts a decline in total operations through 2023, before resuming growth beyond 2023.

TABLE 3-4: O'HARE SHARE OF TOTAL US ENPLANED REVENUE PASSENGERS

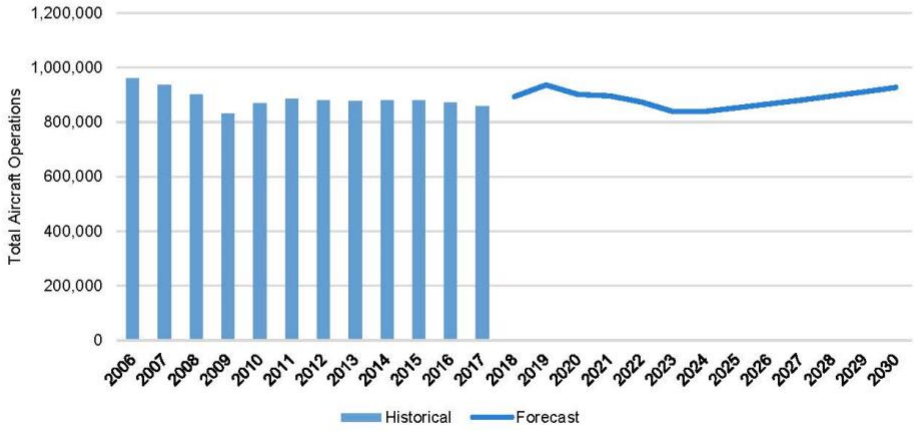
| Calendar Year | O'Hare Revenue Enplaned Passengers | US Revenue Enplaned Passengers | O'Hare Share |
|---|---|---|---|
| **Historical** | | | |
| 2006 | 36,912,685 | 738,795,907 | 5.0% |
| 2007 | 36,214,745 | 754,260,798 | 4.8% |
| 2008 | 33,781,548 | 734,472,232 | 4.6% |
| 2009 | 31,413,715 | 697,321,055 | 4.5% |
| 2010 | 31,917,053 | 707,845,516 | 4.5% |
| 2011 | 31,933,265 | 724,958,030 | 4.4% |
| 2012 | 32,185,476 | 731,874,265 | 4.4% |
| 2013 | 32,344,447 | 739,134,860 | 4.4% |
| 2014 | 34,025,067 | 761,743,554 | 4.5% |
| 2015 | 36,132,722 | 795,434,978 | 4.5% |
| 2016 | 37,555,697 | 828,578,799 | 4.5% |
| 2017 | 38,570,756 | 856,674,314 | 4.5% |
| 2018[1] | 40,312,189 | 897,114,014 | 4.5% |
| **Forecast** | | | |
| 2019 | 42,185,986 | 933,366,426 | 4.5% |
| 2020 | 43,212,898 | 956,904,903 | 4.5% |
| 2021 | 44,146,257 | 978,954,986 | 4.5% |
| 2022 | 45,029,152 | 1,000,221,142 | 4.5% |
| 2023 | 45,879,185 | 1,020,615,320 | 4.5% |
| 2024 | 46,695,722 | 1,039,812,533 | 4.5% |
| 2025 | 47,510,846 | 1,058,787,011 | 4.5% |
| 2026 | 48,332,289 | 1,077,903,370 | 4.5% |
| 2027 | 49,184,652 | 1,097,583,073 | 4.5% |
| 2028 | 50,073,630 | 1,117,817,939 | 4.5% |
| 2029 | 50,994,991 | 1,138,584,800 | 4.5% |
| 2030 | 51,943,183 | 1,159,771,269 | 4.5% |
| **Compound Annual Growth Rate** | | | |
| 2006-2018 | 0.7% | 1.6% | |
| 2018-2030 | 2.1% | 2.2% | |

NOTE: The values depicted in this table have been converted from Federal fiscal year to calendar year.

1 2018 values in the TAF are forecast. Revenue passengers shown and converted to calendar year.

SOURCE: Federal Aviation Administration, *2018 Terminal Area Forecast*, March 2019.

**EXHIBIT 3-1: 2018 TAF AIRCRAFT OPERATIONS FORECAST**




SOURCE: Federal Aviation Administration, *2018 Terminal Area Forecast*, March 2019.

Although the passenger forecast discussed in the prior section appears reasonable, this decline in aircraft operations, which was largely associated with passenger airline operations, warranted additional analysis. A discussion was held with the FAA's TAF Office to discuss the methodology used in the development of the 2018 TAF for ORD, with particular attention to assumptions that influenced the operations forecasts. One challenge of the TAF is it combines passenger aircraft operations with cargo aircraft operations under the Air Carrier and Air Taxi categories, and it is not possible to separate passenger and cargo aircraft operations forecasts. Additionally, certain fleet mix assumptions used in the development of the TAF may not be appropriate for ORD. According to the FAA TAF Office, the TAF assumes that all 50-seat regional jets will be retired from airline fleets by 2023. Further, the TAF does not incorporate fleet changes specific to an airport; rather it uses industry-wide fleet change assumptions applied uniformly to airports' existing fleet. Therefore, a bottom-up assessment of the passenger aircraft fleet mix specific to O'Hare was prepared to more accurately reflect fleet changes likely to occur at the Airport. The resulting fleet mix was used in the development of the passenger aircraft operations forecast.

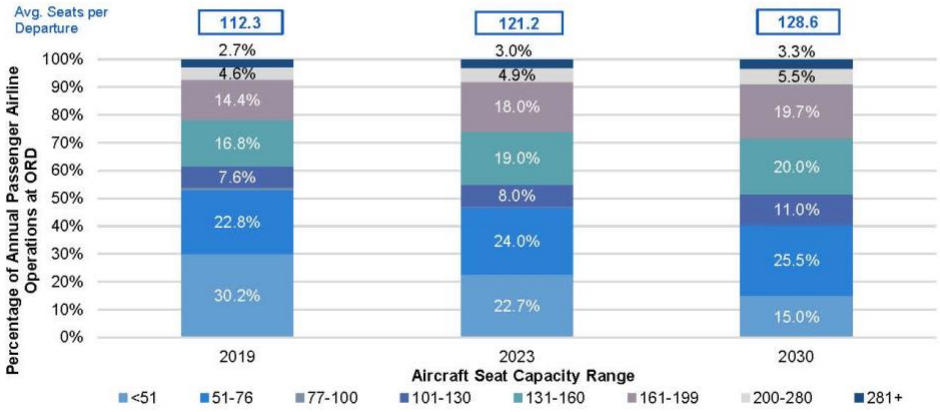
The future O'Hare fleet mix was developed based on current and future aircraft models expected to be available in airline fleets during the forecast period. Sources for these data include published fleet orders for US and major foreign airlines operating at the Airport, annual company filings, and aircraft manufacturer press releases. These were evaluated, as well as the replacement of older aircraft by aircraft on order. Evaluation of the fleet mix extended to the assumptions used by the FAA in the development of the TAF. For example, the FAA assumes the complete retirement of 50-seat aircraft by 2023. We believe that the airlines operating aircraft with 50 seats or fewer will retire some of these aircraft, but that these aircraft will

continue to operate at O'Hare beyond 2023. Other specific assumptions used in the development of the proposed fleet mix for O'Hare include:

- Retirements of 50-seat aircraft at O'Hare are expected to continue throughout the forecast period
  - Retirement of older regional jets will accelerate during the next five years (through 2023)
  - Limited CRJ-200 and ERJ-145 operations are assumed at O'Hare in 2030
  - CRJ-550 aircraft operations have been assumed to operate at O'Hare through 2030
- The McDonnell Douglas MD-83/88 and MD-90 aircraft are not expected to operate at O'Hare beyond 2022
- Airbus A320ceo/neo and Boeing 737NG/MAX family aircraft are modeled in future schedules in proportion with currently-published order books and fleet plans. This fleet mix assumes that:
  - Despite the grounding of the Boeing 737 MAX in March 2019, the aircraft will be operating in airline fleets in 2023
  - By 2023, approximately 30% of A320 and B737 family aircraft at O'Hare will be new engine variants
  - By 2030, approximately 50% of A320 and B737 family aircraft at O'Hare will be new engine variants
- Growth in average aircraft gauge is forecast considering existing orders for large narrow body aircraft (e.g., Airbus A321neo and Boeing 737 MAX 9 and 10 aircraft)
- Boeing 757 operations will be phased out of O'Hare prior to 2030 and replaced by either Boeing 737 MAX, Airbus A321, or Boeing 787 aircraft depending on the type of flight segment (e.g., short haul or long haul)
- Growth in long haul international flying at O'Hare will be supported by both US and foreign carriers
  - Most Boeing 767-300 aircraft will be replaced by Boeing 787 aircraft by 2030
  - The largest aircraft (Airbus A380 and Boeing 747-8) are assumed to operate at O'Hare throughout the forecast period even though there are limited outstanding future orders for the passenger variants of these aircraft

The fleet mix for the base year, 2023, and 2030 are presented in **Exhibit 3-2**. The fleet mix is shown in terms of average seats per departure and by the percentage of aircraft operations conducted within these aircraft seat capacity ranges.

EXHIBIT 3-2: PROPOSED PASSENGER AIRLINE FLEET MIX




SOURCES: Innovata, June 2019; Ricondo & Associates, Inc. (analysis), June 2019.

Seat factors have grown in recent years reaching a peak in 2018 at 84 percent.[5] . Seat factors are forecast to remain largely steady throughout the forecast period. This is consistent with the assumptions used in the 2018 TAF, which forecasts revenue passenger-only seat factors at O'Hare to grow slightly from 82 percent in 2018, to 84 percent by 2045, the final year of forecast activity in the TAF.

The fleet mix, seats per departure, and seat factor forecasts were then applied to the forecast of enplaned passengers to develop the passenger aircraft operations forecast. The passenger aircraft operations forecast is presented in **Table 3-5**. Based on this forecast, passenger aircraft operations are forecast to grow from approximately 877,000 operations in 2018 to nearly 974,000 operations in 2030, a compound annual growth rate of 0.9 percent, lower than the forecast of enplaned passengers.

### 3.1.3 Passenger Airline Activity Forecast Summary

The TAF has been selected as the annual enplaned passenger forecast. The 2018 TAF is a reasonable projection of long-term passenger growth, which is demonstrated by correlation to economic factors and its conservatively-high growth rate relative to growth rates derived from the socioeconomic models explored in Section 3.1.1. Future activity growth is further supported by ORD's role serving a robust origin and destination passenger market within a strong and growing local economy. The Airport's geographic location also makes it a natural connecting hub for the two hub airlines operating from the Airport.

[5] Seat factor is the percentage of seats filled on an aircraft. Although seat factor is often referred to as load factor, load factor takes into account distance and represents revenue passenger miles divided by available seat miles.

TABLE 3-5: PASSENGER AIRCRAFT OPERATIONS FORECAST AND SEAT FACTOR

| Year | Total Passenger Aircraft Operations | Average Seats Per Departure | Total Enplaned Passengers[1] | Average Seat Factor |
|---|---|---|---|---|
| **Historical** | | | | |
| 2006 | 932,874 | 104.2 | 38,122,240 | 78.4% |
| 2007 | 913,945 | 104.6 | 37,402,803 | 78.2% |
| 2008 | 874,177 | 104.3 | 34,890,004 | 76.5% |
| 2009 | 832,398 | 102.7 | 32,440,094 | 75.9% |
| 2010 | 864,286 | 96.7 | 32,963,479 | 78.9% |
| 2011 | 875,138 | 95.9 | 32,980,669 | 78.6% |
| 2012 | 870,956 | 95.1 | 33,242,124 | 80.3% |
| 2013 | 870,228 | 94.0 | 33,402,530 | 81.7% |
| 2014 | 872,179 | 97.0 | 35,136,941 | 83.1% |
| 2015 | 871,583 | 104.6 | 37,317,207 | 81.9% |
| 2016 | 862,187 | 109.2 | 38,785,696 | 82.4% |
| 2017 | 862,030 | 113.0 | 39,826,556 | 81.8% |
| 2018 | 877,461 | 111.9 | 41,623,010 | 84.8% |
| **Forecast** | | | | |
| 2019 | 912,737 | 112.3 | 43,560,290 | 85.0% |
| 2020 | 914,029 | 114.9 | 44,620,281 | 85.0% |
| 2021 | 915,044 | 117.1 | 45,583,343 | 85.1% |
| 2022 | 916,379 | 119.2 | 46,494,099 | 85.1% |
| 2023 | 918,075 | 121.2 | 47,370,842 | 85.1% |
| 2024 | 924,654 | 122.2 | 48,212,837 | 85.3% |
| 2025 | 931,555 | 123.2 | 49,053,364 | 85.5% |
| 2026 | 939,218 | 124.2 | 49,900,388 | 85.6% |
| 2027 | 947,240 | 125.2 | 50,779,408 | 85.6% |
| 2028 | 955,702 | 126.2 | 51,696,340 | 85.7% |
| 2029 | 964,531 | 127.2 | 52,646,798 | 85.7% |
| 2030 | 973,592 | 128.6 | 53,625,042 | 85.7% |
| **Compound Annual Growth Rate** | | | | |
| 2006-2018 | (0.5%) | | 0.7% | |
| 2018-2030 | 0.9% | | 2.1% | |

NOTE: The values depicted in this table have been converted from Federal fiscal year to calendar year.

1 2018 values in the TAF are forecast

SOURCES: Federal Aviation Administration, *2018 Terminal Area Forecast*, March 2019 (converted to calendar year); US DOT Form T-100 (historical), date accessed June 2019; Ricondo & Associates, Inc. (analysis), June 2019.

The passenger aircraft operations forecast is based on an independent analysis of airline fleet plans and expectations of airlines' use of aircraft at the Airport, and the TAF passenger forecast. While certain assumptions used in the 2018 TAF aircraft operations forecast have been considered, the adjusted passenger aircraft operations forecast has been modelled using specific assumptions for future aircraft gauge and seat factors at ORD. These have been applied to the 2018 TAF enplaned passenger forecast to generate a forecast of passenger airline operations. The forecast of total enplaned passengers and aircraft operations is summarized in **Table 3-6**.

**TABLE 3-6: ENPLANED PASSENGERS AND AIRCRAFT OPERATIONS FORECAST**

| Year | Total Enplaned Passengers[1] | Total Passenger Aircraft Operations |
|---|---|---|
| **Historical** | | |
| 2006 | 38,122,240 | 932,874 |
| 2007 | 37,402,803 | 913,945 |
| 2008 | 34,890,004 | 874,177 |
| 2009 | 32,440,094 | 832,398 |
| 2010 | 32,963,479 | 864,286 |
| 2011 | 32,980,669 | 875,138 |
| 2012 | 33,242,124 | 870,956 |
| 2013 | 33,402,530 | 870,228 |
| 2014 | 35,136,941 | 872,179 |
| 2015 | 37,317,207 | 871,583 |
| 2016 | 38,785,696 | 862,187 |
| 2017 | 39,826,556 | 862,030 |
| 2018 | 41,623,010 | 877,461 |
| **Forecast** | | |
| 2019 | 43,560,290 | 912,737 |
| 2020 | 44,620,281 | 914,029 |
| 2021 | 45,583,343 | 915,044 |
| 2022 | 46,494,099 | 916,379 |
| 2023 | 47,370,842 | 918,075 |
| 2024 | 48,212,837 | 924,654 |
| 2025 | 49,053,364 | 931,555 |
| 2026 | 49,900,388 | 939,218 |
| 2027 | 50,779,408 | 947,240 |
| 2028 | 51,696,340 | 955,702 |
| 2029 | 52,646,798 | 964,531 |
| 2030 | 53,625,042 | 973,592 |
| **Compound Annual Growth Rate** | | |
| 2006-2018 | 0.7% | (0.5%) |
| 2018-2030 | 2.1% | 0.9% |

NOTE: The values depicted in this table have been converted from Federal fiscal year to calendar year.

1 2018 values in the TAF are forecast, enplaned passenger volumes include nonrevenue passengers.

SOURCES: Federal Aviation Administration, *2018 Terminal Area Forecast*, March 2019 (converted to calendar year); US DOT Form T-100 (historical), June 2019; Ricondo & Associates, Inc. (analysis), June 2019.

## 3.2 Cargo Airline Aircraft Operations Forecast

Cargo airline operations were developed using forecasts of future cargo volumes carried by freighter aircraft (excluding belly cargo on passenger aircraft) and the expected average volume per operation. Cargo carried by freighter aircraft represented approximately 77 percent of all cargo handled at O'Hare in 2018. O'Hare has experienced a resumption of growth in cargo activity since 2014 (the first year of growth since the recession). This growth is consistent with industry-wide activity which has grown during the same period. It is further supported by Chicago's role as a worldwide logistics hub, and as a major port for international cargoes.

Two methodologies were explored to forecast cargo volumes:

- **Single Variable Regression Analysis**: This approach uses a similar methodology as described in the evaluation of the enplaned passenger forecast. Predictive relationships between historical cargo activity at the Airport and historical variables such as population and economic activity were identified. Independent projections of these socioeconomic variables were then used to forecast cargo volumes carried by freighter aircraft at the Airport.
- **Market Share Analysis**: This approach is based on the expectation of how cargo activity at O'Hare will grow relative to the rest of the industry. Since 2014, ORD's share of total US freighter revenue ton miles (RTMs) has grown from 5.0 percent to 6.3 percent. RTMs are a measure of one revenue-producing ton of freight carried one mile. An increasing share was assumed to continue during the forecast period based on historical trends. By 2030 ORD's share of US volumes is assumed to grow to 6.6 percent, which is the same magnitude of change experienced at O'Hare between 2016 and 2018. This increased share was applied to the cargo RTM forecast from the *2019 FAA Aerospace Forecast* which resulted in a freighter aircraft RTM forecast.

  The FAA's forecasts of RTMs use models that link cargo activity to GDP. Forecasts of domestic cargo RTMs use real U.S. GDP as the primary driver of activity. Projections of international cargo RTMs depend on growth in world and regional GDP, adjusted for inflation. FAA forecasts the distribution of RTMs between passenger and all-cargo carriers based on an analysis of historic trends in shares, changes in industry structure, and market assumptions. Other forecasts of cargo activity were evaluated, including the Boeing World Cargo forecast which projects domestic air cargo to grow at up to 2.8 percent over the next 20 years.

The single variable regression analysis yielded a 2018 to 2030 compound annual growth rate of 3.0 percent, while the market share analysis yielded a 4.0 percent growth rate during the period. The market share analysis was selected for use since it yielded a higher growth rate and passenger forecast, and thus more conservative for purposes of the TAP EA analysis. The forecast of cargo RTMs in presented in **Table 3-7**.

TABLE 3-7: CARGO AIRCRAFT REVENUE TON MILE FORECAST

| Year | O'Hare Cargo Aircraft Departing RTMs (Millions) | US Total RTMs (Millions) | O'Hare Share of Total |
|---|---|---|---|
| **Historical** | | | |
| 2006 | 1,854 | 36,235 | 5.1% |
| 2007 | 1,906 | 36,235 | 5.3% |
| 2008 | 1,643 | 36,235 | 4.5% |
| 2009 | 1,237 | 36,235 | 3.4% |
| 2010 | 1,550 | 36,235 | 4.3% |
| 2011 | 1,533 | 36,823 | 4.2% |
| 2012 | 1,429 | 35,127 | 4.1% |
| 2013 | 1,503 | 34,287 | 4.4% |
| 2014 | 1,764 | 35,025 | 5.0% |
| 2015 | 2,115 | 35,762 | 5.9% |
| 2016 | 2,157 | 36,604 | 5.9% |
| 2017 | 2,483 | 40,079 | 6.2% |
| 2018 | 2,712 | 43,384 | 6.3% |
| **Forecast** | | | |
| 2019 | 2,873 | 45,736 | 6.3% |
| 2020 | 3,001 | 47,559 | 6.3% |
| 2021 | 3,112 | 49,097 | 6.3% |
| 2022 | 3,216 | 50,502 | 6.4% |
| 2023 | 3,312 | 51,775 | 6.4% |
| 2024 | 3,417 | 53,177 | 6.4% |
| 2025 | 3,543 | 54,890 | 6.5% |
| 2026 | 3,687 | 56,859 | 6.5% |
| 2027 | 3,840 | 58,960 | 6.5% |
| 2028 | 3,997 | 61,101 | 6.5% |
| 2029 | 4,160 | 63,310 | 6.6% |
| 2030 | 4,322 | 65,487 | 6.6% |
| **Compound Annual Growth Rate** | | | |
| 2014-2018 | 3.2% | 1.5% | |
| 2018-2030 | 4.0% | 3.5% | |

NOTES: The 2019 FAA Aerospace forecast has been converted to calendar year for use in these analyses

RTMs- Revenue Ton Miles.

SOURCES: US DOT Form T-100 (historical), date accessed June 2019; *2019 FAA Aerospace Forecast*, April 2019; Ricondo & Associates, Inc. (analysis), June 2019.

Cargo airline operations were forecast by applying an average RTM per departure to the forecast of freighter aircraft RTMs. Since 2014 cargo RTMs per departure have increased from 93,189 to 109,624, driven by the use of larger capacity aircraft and longer lengths of haul, resulting from increased international cargo activity. This trend is expected to continue as international cargo volumes are forecast to grow at a faster rate during the forecast period. Increased RTMs per operation will occur through increased capacity of cargo aircraft and the longer lengths of haul. International cargo activity is predominantly conducted with

large widebody aircraft such as the B747F and B777F, which have higher average capacities than cargo aircraft operating domestically such as the MD-11F, B767F, A300F, and B757F. International flights travel longer distances than domestic cargo flights, including those transiting at ANC, and will thus result in a longer length of haul for each operation. RTMs per departure are forecast to grow from 109,624 in 2018 to 126,068 in 2030, a compound annual growth rate of 1.2 percent. Total cargo aircraft operations are forecast to grow from 24,739 in 2018 to 34,283 in 2030, a compound annual growth rate of 2.8 percent. The forecast of cargo RTMs, RTMs per departure, and cargo airline operations are presented in **Table 3-8**.

**TABLE 3-8: CARGO AIRCRAFT OPERATIONS FORECAST**

| Year | O'Hare Departing RTMs (millions) | RTMs Per Departure | Total Operations |
|---|---|---|---|
| **Historical** | | | |
| 2006 | 1,854 | 71,575 | 25,896 |
| 2007 | 1,906 | 74,283 | 25,652 |
| 2008 | 1,643 | 77,080 | 21,309 |
| 2009 | 1,237 | 71,743 | 17,242 |
| 2010 | 1,550 | 82,076 | 18,885 |
| 2011 | 1,533 | 78,999 | 19,399 |
| 2012 | 1,429 | 80,598 | 17,730 |
| 2013 | 1,503 | 83,831 | 17,929 |
| 2014 | 1,764 | 93,189 | 18,924 |
| 2015 | 2,115 | 98,103 | 21,559 |
| 2016 | 2,157 | 96,561 | 22,333 |
| 2017 | 2,483 | 103,140 | 24,074 |
| 2018 | 2,712 | 109,624 | 24,739 |
| **Forecast** | | | |
| 2019 | 2,873 | 111,002 | 25,878 |
| 2020 | 3,001 | 112,361 | 26,704 |
| 2021 | 3,112 | 113,739 | 27,361 |
| 2022 | 3,216 | 115,116 | 27,937 |
| 2023 | 3,312 | 116,484 | 28,433 |
| 2024 | 3,417 | 117,852 | 28,994 |
| 2025 | 3,543 | 119,221 | 29,718 |
| 2026 | 3,687 | 120,584 | 30,572 |
| 2027 | 3,840 | 121,963 | 31,485 |
| 2028 | 3,997 | 123,326 | 32,410 |
| 2029 | 4,160 | 124,700 | 33,360 |
| 2030 | 4,322 | 126,068 | 34,283 |
| **Compound Annual Growth Rate** | | | |
| 2006-2018 | 3.2% | 3.6% | (0.4%) |
| 2018-2030 | 4.0% | 1.2% | 2.8% |

NOTES: The 2019 FAA Aerospace forecast was used to forecast RTMs and has been converted to calendar year for use in these analyses.

RTMs- Revenue Ton Miles.

SOURCES: US DOT Form T-100 (historical), date accessed June 2019; *2019 FAA Aerospace Forecast*, April 2019; Ricondo & Associates, Inc. (analysis), June 2019.

## 3.3 General Aviation and Military Aircraft Operations Forecast

Historically, general aviation and military aircraft operations have been minor components of traffic at the Airport. At O'Hare, general aviation and military activity combined accounted for 0.6 percent of total aircraft operations[6]. O'Hare is surrounded by multiple reliever airports that handle most of the general aviation traffic around the Chicago region, including Chicago Executive Airport (PWK) and DuPage County Airport (DPA). Military activity is limited at O'Hare as there are no military aircraft based at the Airport. Due to the limited nature of these historical activities, the TAF was reviewed and ultimately selected to serve as the forecast of general aviation and military activity.

The TAF provides forecasts for both segments of activity. In the TAF, general aviation forecasts are based primarily on time series analyses of recent activity. Military activity is forecast at present levels unless the Department of Defense has provided specific inputs (e.g., a base closure moving a tenant unit to another airport). The forecasts of general aviation and military activity converted to calendar year are contained in **Table 3-9**.

## 3.4 Total Aircraft Operations Forecasts

The aircraft operations forecasts are summarized in **Table 3-10**. A comparison to the 2018 TAF aircraft operations forecast is presented in **Exhibit 3-3**.

These forecasts are unconstrained, which is consistent with the methodology used for the TAF[7]. Aircraft operations in the proposed forecast grow from 893,497 in 2018 to 1,013,856 in 2030, a compound annual growth rate of 0.9 percent. Aircraft operations in the 2018 TAF grow from 893,497 in 2018[8] to 926,881 in 2030, a compound annual growth rate of 0.3 percent. The difference between the forecasts is due to the different assumptions used in the passenger aircraft forecasts, as explained in Section 3.1.2.

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6 Based on 2018 data.

7 However, if the airport historically functions under constrained conditions, the FAA forecast may reflect those constraints since they are embedded in historical data.

8 2018 values in the TAF are forecast.

TABLE 3-9: GENERAL AVIATION AND MILITARY AIRCRAFT OPERATIONS FORECASTS

| Year | General Aviation Aircraft Operations | Military Aircraft Operations |
|---|---|---|
| **Historical** | | |
| 2006 | 21,745 | 248 |
| 2007 | 12,480 | 187 |
| 2008 | 8,622 | 158 |
| 2009 | 7,050 | 164 |
| 2010 | 7,471 | 172 |
| 2011 | 7,674 | 151 |
| 2012 | 7,698 | 194 |
| 2013 | 7,560 | 153 |
| 2014 | 7,233 | 156 |
| 2015 | 6,903 | 152 |
| 2016 | 6,696 | 109 |
| 2017 | 5,885 | 108 |
| 2018[1] | 5,770 | 75 |
| **Forecast** | | |
| 2019 | 5,906 | 75 |
| 2020 | 5,906 | 75 |
| 2021 | 5,906 | 75 |
| 2022 | 5,906 | 75 |
| 2023 | 5,906 | 75 |
| 2024 | 5,906 | 75 |
| 2025 | 5,906 | 75 |
| 2026 | 5,906 | 75 |
| 2027 | 5,906 | 75 |
| 2028 | 5,906 | 75 |
| 2029 | 5,906 | 75 |
| 2030 | 5,906 | 75 |
| **Compound Annual Growth Rate** | | |
| 2006-2018 | (10.5%) | (9.5%) |
| 2018-2030 | 0.2% | 0.0% |

NOTES: The 2018 Terminal Area Forecast has been converted from Federal fiscal year to calendar year for use in these analyses.

1 2018 values in the TAF are forecast

SOURCE: Federal Aviation Administration, *2018 Terminal Area Forecast*, March 2019.

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TABLE 3-10: TOTAL AIRCRAFT OPERATIONS FORECASTS

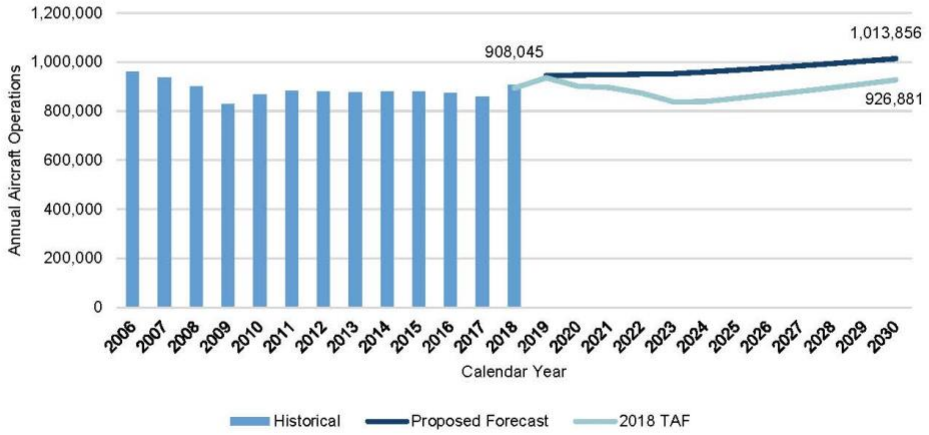
| Year | Passenger Airline | Cargo Airline | General Aviation | Military | Total |
|---|---|---|---|---|---|
| **Historical** | | | | | |
| 2006 | 932,874 | 25,896 | 21,745 | 248 | 980,763 |
| 2007 | 913,945 | 25,652 | 12,480 | 187 | 952,264 |
| 2008 | 874,177 | 21,309 | 8,622 | 158 | 904,266 |
| 2009 | 832,398 | 17,242 | 7,050 | 164 | 856,854 |
| 2010 | 864,286 | 18,885 | 7,471 | 172 | 890,814 |
| 2011 | 875,138 | 19,399 | 7,674 | 151 | 902,362 |
| 2012 | 870,956 | 17,730 | 7,698 | 194 | 896,578 |
| 2013 | 870,228 | 17,929 | 7,560 | 153 | 895,870 |
| 2014 | 872,179 | 18,924 | 7,233 | 156 | 898,492 |
| 2015 | 871,583 | 21,559 | 6,903 | 152 | 900,197 |
| 2016 | 862,187 | 22,333 | 6,696 | 109 | 891,325 |
| 2017 | 862,030 | 24,074 | 5,885 | 108 | 892,097 |
| 2018[1/] | 877,461 | 24,739 | 5,770 | 75 | 908,045 |
| **Forecast** | | | | | |
| 2019 | 912,737 | 25,878 | 5,906 | 75 | 944,596 |
| 2020 | 914,029 | 26,704 | 5,906 | 75 | 946,714 |
| 2021 | 915,044 | 27,361 | 5,906 | 75 | 948,386 |
| 2022 | 916,379 | 27,937 | 5,906 | 75 | 950,297 |
| 2023 | 918,075 | 28,433 | 5,906 | 75 | 952,489 |
| 2024 | 924,654 | 28,994 | 5,906 | 75 | 959,629 |
| 2025 | 931,555 | 29,718 | 5,906 | 75 | 967,254 |
| 2026 | 939,218 | 30,572 | 5,906 | 75 | 975,771 |
| 2027 | 947,240 | 31,485 | 5,906 | 75 | 984,706 |
| 2028 | 955,702 | 32,410 | 5,906 | 75 | 994,093 |
| 2029 | 964,531 | 33,360 | 5,906 | 75 | 1,003,872 |
| 2030 | 973,592 | 34,283 | 5,906 | 75 | 1,013,856 |
| **Compound Annual Growth Rate** | | | | | |
| 2006-2018 | (0.5%) | (0.4%) | (10.5%) | (9.5%) | (0.6%) |
| 2018-2030 | 0.9% | 2.8% | 0.2% | 0.0% | 0.9% |

NOTES: The 2018 Terminal Area Forecast has been converted from Federal fiscal year to calendar year for use in these analyses.

1 2018 values in the TAF are forecast

SOURCES: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019; Ricondo & Associates, Inc. (analysis), June 2019.

EXHIBIT 3-3: COMPARISON OF AIRCRAFT OPERATIONS FORECASTS




NOTES: The 2018 Terminal Area Forecast has been converted from Federal fiscal year to calendar year for use in these analyses. 2018 values in the TAF are forecast.

SOURCES: Federal Aviation Administration, 2018 Terminal Area Forecast, March 2019; Ricondo & Associates, Inc. (analysis), June 2019.

# 4. Constrained Activity Analysis

As previously mentioned, the TAF is assumed to reflect the unconstrained demand for aviation activity at O'Hare. This section assesses whether there is any evidence that, because O'Hare has operated in a constrained environment, demand exists that may be generated above that forecast in the TAF, induced by near-term or TAP facility development.

Specifically, the following questions were investigated:

- Have O'Hare gate constraints resulted in fewer passengers historically flowing to, from, or through ORD, thus causing the TAF to start future growth from an artificially low base?
- Have or will the addition of gates create facility capacity and therefore a more competitive environment that has or would result in passenger activity greater than would exist without the facility changes?
- Will product improvements prompted by the TAP cause a higher proportion of passenger traffic to choose O'Hare to support their journeys?

A review of passenger and operational activity growth following the lifting of flight caps in 2008 includes several factors that could mask the influence of gates on passenger activity. For example, the period included an economic recession, airline mergers, and a shift to a profit-driven, rather than a market share-

driven, airline industry business model. Therefore, in order to determine if there is evidence that terminal facilities at the airport may induce demand above that of the TAF, the following was assessed:

- Evidence that airlines could increase capacity at O'Hare today to accommodate profitable demand, and gate capacity has not caused passenger flow diversion.
- An illustration that American's new gates (growth from 66 to 71) have not enabled growth that couldn't have been accommodated on its original 66 gates and has not resulted in passenger growth at O'Hare greater than system growth.
- An illustration that while O'Hare will have improvements that will be attractive for airlines operations, O'Hare is not unique, and several other large hub airports are also adding gates and improving terminal facilities.

## 4.1 Airlines Could Increase Capacity at O'Hare Today to Accommodate Profitable Demand

An analysis of terminal facility capacity was performed to determine if profitable demand was currently unserved in the market due to facility constraints. A variety of evidence supports the case that airlines could serve additional passengers with the existing terminal facilities.

Airlines serving O'Hare could offer additional seat capacity using the gate resources offered today. **Exhibit 4-1** illustrates the current use of O'Hare gates on a representative day and indicates in red, aircraft that could be replaced with higher capacity aircraft while complying with the operational rules of each gate. **Table 4-1** illustrates the airline-specific opportunities to increase aircraft size at O'Hare with aircraft currently operating in airline fleets today. Upgauging could provide an additional 15.9 percent growth over the seat capacity offered today. With over 24,000 additional seats on the representative day, this could result in an estimated 9 million annual seats. This would be an aggressive utilization of the facilities and constraints or delays may prevent this level of use, but it does demonstrate that there is material growth potential with the existing facilities.

**EXHIBIT 4-1: SERVICE AT O'HARE THAT COULD BE OPERATED WITH HIGHER-CAPACITY AIRCRAFT**


SOURCES: Innovata, June 2019; Ricondo & Associates, Inc. (analysis), June 2019.

**TABLE 4-1: ADDITIONAL SEATS THAT COULD BE OFFERED WITH HIGHER-CAPACITY AIRCRAFT**

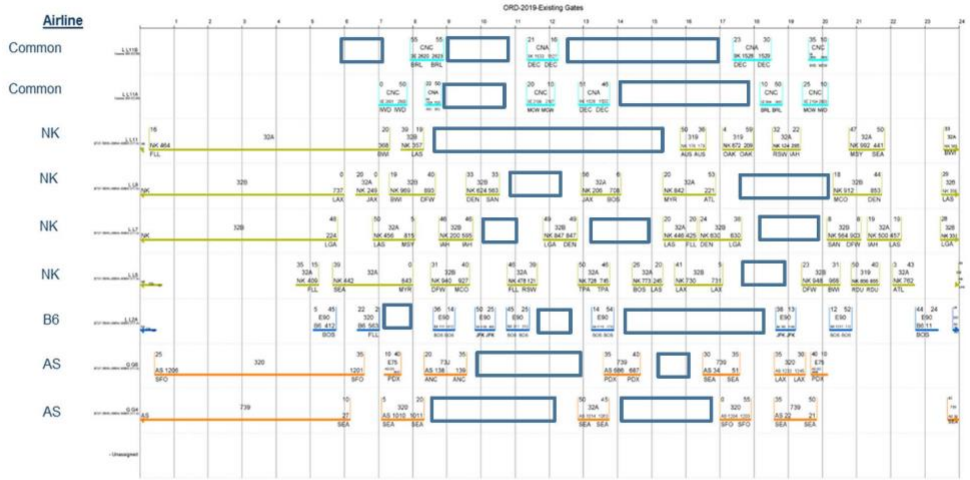
| Airline | Current Seats | Maximum Seats | Difference | Percentage |
|---|---|---|---|---|
| United | 66,384 | 77,423 | 11,039 | 16.6% |
| American | 55,445 | 65,746 | 10,301 | 18.6% |
| Common Use Carriers | 16,357 | 16,832 | 475 | 2.9% |
| Delta | 6,884 | 8,297 | 1,413 | 20.5% |
| Spirit | 5,947 | 6,840 | 893 | 15.0% |
| Alaska | 1,705 | 1,856 | 151 | 8.9% |
| JetBlue | 850 | 1,200 | 350 | 41.2% |
| Air Canada | 1,182 | 1,182 | 0 | 0.0% |
| Total Airport | 154,754 | 179,376 | 24,622 | 15.9% |

NOTE: United, American, Delta, Spirit, Alaska, JetBlue, and Air Canada operate from preferential use gates. All other airlines operate from common use gates.

SOURCES: Innovata, June 2019; Ricondo & Associates, Inc. (analysis), June 2019.

In addition to the ability of airlines to increase seat capacity at O'Hare using larger aircraft, airlines could offer additional flights at the Airport throughout the day at numerous times when gates are unused. **Exhibit 4-2** shows gate use on a representative day for several airlines in the L Concourse at O'Hare (non-American) and Alaska which operates from G Concourse. These carriers, which operate at O'Hare with relatively few gates still have periods throughout the day where additional flights could be added. While not shown, similar opportunities exist for an increase in flights throughout the day for United and American.

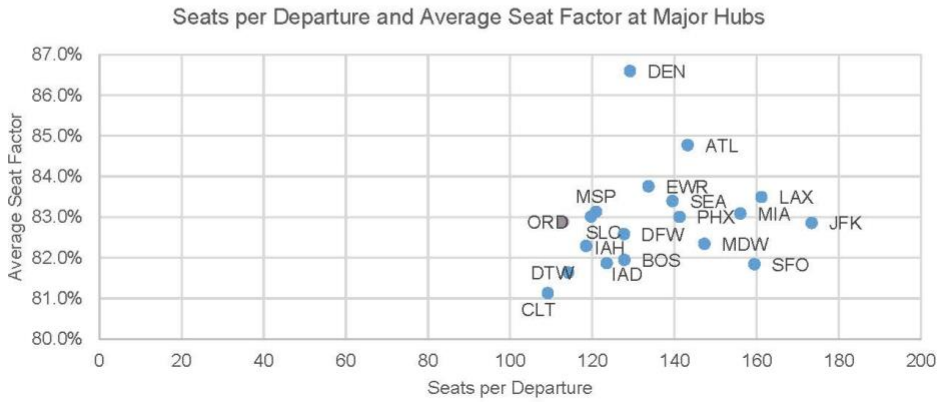
**EXHIBIT 4-2: GATING CHART OF SELECTED AIRLINES AT O'HARE**




SOURCES: Innovata, Ricondo & Associates, Inc. (analysis), June 2019.

In addition to upguaging and additional flights, seat factors may be able to increase, allowing airlines to accommodate additional passengers with existing capacity. **Exhibit 4-3** demonstrates that O'Hare could grow in terms of seat factors, as there are several airports with higher seat factors including mid-continent hubs.

**EXHIBIT 4-3: SEATS PER DEPARTURE AND AVERAGE SEAT FACTOR AT MAJOR HUBS**




NOTE: Data are for the twelve months ending November 2018.

SOURCE: U.S. DOT T-100, June 2019.

## 4.2 New American Gates Did Not Induce Passenger Growth

In May 2018 five new gates were opened at ORD. These gates are preferential use gates for American. The new gate capacity gained by American does not appear to be the catalyst that was required for the carrier to offer seat growth at ORD. **Table 4-2** presents a comparison of schedule metrics (daily departures and seats – both in total and on a per-gate basis) for American and United at O'Hare for the third and fourth quarters of 2017 (before American gained five incremental gates in May 2018), and the same quarters in 2018 and 2019. United's gate allotment remained unchanged throughout this period. Exhibit 16 also shows peak hour arrivals, departures, and total operations (these peaks do not necessarily occur in the same hour, so the numbers are not additive) both on a total and per-gate basis. American could provide its 2019 departure and seat capacity on its original 66 gates by operating at similar per-gate levels operated by United. American grew seat capacity at a rate that was higher than United, but American's seat capacity and flights could have been accommodated on existing gates when measured by utilization rate. United's growth during the same period was done without additional gates and achieved through higher utilization of gates. It may be reasonable to question if the incremental gate capacity induced competition resulting in better utilization of gates and increased seat capacity. However, United's systemwide departure growth was in-line with that experienced at O'Hare in the same period (10.9% system vs 10.4% at ORD). Additional gate capacity did not induce demand at the Airport.

TABLE 4-2: O'HARE HUB CARRIER SCHEDULE METRICS

Comparison of Schedule Metrics for Q3 and Q4 Only

| | | | | | | | | Peak Hour | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Gates | Daily Depts | Daily Seats | Daily Depts Per Gate | Daily Seats Per Gate | Seats/ Dept | Arrivals | Departures | Operations | Arr/Gate | Dept/ Gate | Ops/Gate |
| **United Airlines** | | | | | | | | | | | | |
| 2017 | 81 | 557 | 60,064 | 6.9 | 742 | 107.9 | 66 | 69 | 116 | 0.81 | 0.85 | 1.4 |
| 2018 | 81 | 605 | 62,901 | 7.5 | 777 | 104.0 | 66 | 72 | 126 | 0.81 | 0.89 | 1.6 |
| 2019 | 81 | 615 | 63,764 | 7.6 | 787 | 103.7 | 67 | 70 | 131 | 0.83 | 0.86 | 1.6 |
| 2017-2019 Change | 0.0% | 10.4% | 6.2% | 10.4% | 6.2% | -3.9% | 1.5% | 1.4% | 12.9% | 1.5% | 1.4% | 12.9% |
| **American Airlines** | | | | | | | | | | | | |
| 2017 | 66 | 458 | 47,516 | 6.9 | 720 | 103.8 | 53 | 54 | 91 | 0.80 | 0.82 | 1.4 |
| 2018 | 71 | 461 | 48,801 | 6.5 | 687 | 105.9 | 55 | 57 | 90 | 0.77 | 0.80 | 1.3 |
| 2019 | 71 | 499 | 51,988 | 7.0 | 732 | 104.2 | 56 | 57 | 89 | 0.79 | 0.80 | 1.3 |
| 2019 (if at 66 gates) | 66 | 499 | 51,988 | 7.6 | 788 | 104.2 | 56 | 57 | 89 | 0.85 | 0.86 | 1.3 |
| 2017-2019 Change | 7.6% | 9.0% | 9.4% | 1.3% | 1.7% | 0.4% | 5.7% | 5.6% | -2.2% | -1.8% | -1.9% | -9.1% |

NOTE: American added five gates in May 2018.

SOURCES: Innovata for Q3 and Q4 of years indicated, Ricondo & Associates, Inc. (analysis)

## 4.3 O'Hare Development is Keeping it Competitive as Other Hubs Undertake Improvements

The TAP will improve facilities and connectivity at the airport potentially making it a more attractive facility for airlines or passengers to travel. However, there are many other airports in the U.S. undergoing terminal projects which will compete with O'Hare for passengers or airline capacity. The list below illustrates examples of other airport facility growth that will compete with O'Hare limiting the likelihood that traffic will shift significantly from other hubs. The information presented was gathered from various financial disclosure documents and press releases.

- ATL - 10-gate Concourse G, which would be international-arrivals capable and connected to an existing US Customs and Border Protection (CBP) facility
- BOS - 7 gates are expected to be added over two phases. This project also includes the addition of ticket counters, increases in CBP facilities, and additional luggage carousels
- CLT - Concourse A expansion: relocate the existing gates and 5 additional new gates
- DFW – New Terminal F
- DEN - Expansion of Concourses A, B, and C: 12 gates added to Concourse A, 11 gates added to Concourse B, and 16 gates added to Concourse C
- JFK – New or Redeveloped Terminal 6/7 and Terminal 1
- LGA – Redevelopment of Terminals B (new 1.39-million-square-foot Terminal B, including 35 gates) and C/D (1.2 million square feet, 37 gates)
- LAX - New 12-gate 800,000-square-foot concourse (Midfield Satellite Concourse)
- MIA - Terminal Optimization Program (TOP): rehabilitating and renovating Central Terminal
- EWR - Terminal One Redevelopment Program will replace Terminal A, the airport's oldest terminal, with a modern terminal building. Terminal One will have 33 aircraft gates
- MCO - South Terminal Complex: 16 gates to accommodate domestic and international arrivals and widebody aircraft
- SLC - Terminal Redevelopment Program (TRP): replace terminal complex and development of a consolidated terminal facility. North Concourse Program (NCP): 31-gate midfield concourse and connection from the South Concourse and TRP
- SFO - Ascent Program: Terminal 1 redevelopment and includes the addition of 6 new gates
- SEA - New International Arrivals Facility, North Satellite Renovation and Expansion Project: includes renovating, reconfiguring, and expanding the terminal to add 8 gates
- TPA- Main Terminal Expansion: adds 33,000 square feet

# 5. Summary and Conclusion

The FAA's TAF is a reasonable forecast of passenger activity. The growth is in-line with, or exceeds, the implied growth rates of passenger demand based on predictive relationships identified with key socioeconomic variables. The TAF passenger growth is also in-line with assumptions of market growth and ORD's portion of that market. The near-term operational activity included in the 2018 TAF appears to be low, and an alternative operational forecast is proposed to better reflect anticipated ORD-specific fleet changes.

Recent, future baseline, or TAP projects that increase gate capacity are anticipated to accommodate the TAF passenger and proposed operational forecast growth. These gate projects do not induce passenger activity above that included in the TAF. The industry has evolved and is able to accommodate profitable growth through capacity growth and is no longer "shrinking to profitability". O'Hare is a critical component of the domestic and global route network, and the Airport should be expected to be utilized to accommodate profitable demand through additional airline capacity. The airlines serving O'Hare today, including both the hub carriers American and United, as well as other low-cost and traditional network carriers can add seat capacity and are not currently constrained by gates. Additional gate capacity provided through near-term gate projects and the TAP will help the Airport's airlines accommodate future growth that is expected to materialize as depicted by the FAA's TAF for O'Hare and keep the Airport competitive with other airports as they develop.

The following conclusions reflect the findings to the specific questions presented in the beginning of Section 3:

- The historical basis for the TAF does not appear to reflect an artificially low base. The concern that passenger activity has been constrained due to gate capacity at ORD, and therefore the TAF is forecast on an artificially low base, presumes that there exists a component of passenger demand today that is not served due to lack of gate capacity at the Airport. The analysis included in Section 3.1 has shown that airlines will increase capacity to accommodate profitable passengers, and that airlines at O'Hare could reasonably add capacity without additional gates. Therefore, all components of profitable demand are currently being served, with O'Hare maintaining a leading role in the nationwide route network, and no latent demand exists.
- Gate capacity has not, and is not, anticipated to induce passenger activity that is greater than that included in the TAF. Review of gate capacity demonstrates airlines could currently add seat capacity through additional flights, increased load factors, and upgauging of fleet. New American gates added in May 2018 did not induce airline capacity that either could not be accommodated on existing gates or was greater than systemwide capacity growth.
- The improvements prompted by TAP are not anticipated to cause a higher proportion of connecting passenger traffic at ORD. While there could be some increase, similar improvements at other airports will compete for connecting traffic.

# 6. Project Phasing Overview

An understanding of historical and future terminal facilities is necessary to gauge the utilization that will occur over time with the proposed forecast. The TAP is anticipated to be developed in phases during the construction process. Key considerations in the development of the phasing schedule included: (1) that airfield flows must be maintained around the terminal core; (2) that all gates when delivered will have a capable pedestrian route from curb to gate; and (3) the construction phasing will rely on but minimize, the use of temporary facilities. The phasing plan will use increments of additional linear gate frontage in order to facilitate the closure of existing terminal facilities for construction purposes. At various stages, some of this construction is anticipated to result in incremental gate frontage. Gate sizes are not uniform and are dependent on aircraft gauge. The TAP includes Multiple Aircraft Ramp System (MARS) gates which can accommodate multiple aircraft gauges. Because these gates allow airlines to dynamically shift gate capabilities as their schedules demand, the total number of gates at the Airport will vary at any given point.

**Table 6-1** depicts historical and planned gate counts and linear gate frontage, respectively, between 2006 and 2023, as well as calculations of enplaned passengers, departing seats, and total passenger aircraft operations per gate.

The airport gate count has fluctuated from 186 in 2006, up to 189 in 2012, and then to 185 in 2017 despite no change in linear gate frontage as airlines reconfigured gate positions to accommodate the changing average aircraft size. In 2018, an additional 535 linear feet of gate frontage was added on concourse L, resulting in five additional gate positions. A sixth gate was added by reconfiguring the existing linear gate frontage for United.

Linear gate frontage and the airport gate count will increase again when the future baseline projects are completed in 2021. These are non-TAP projects including the Terminal 5 extension and the L-concourse stinger expansion. This results in the addition of between 16 and 22 gates from the existing condition (April 2017), depending on configuration of the gates. Beyond 2021, linear gate frontage will not decrease at any point during the construction process. Incremental linear gate frontage will primarily be used to offset closures in other areas of the Airport as a part of the construction process.

Between completion of the future baseline and 2024, no incremental gate frontage will be provided. By the end of 2024, an incremental 644 linear feet of gate frontage will be available. By the end of 2025, a further 928 linear feet of incremental gate frontage will become available. The number of gates this frontage could accommodate is variable and will depend on the aircraft gauge capabilities of any gates. Beyond Q4 2025, no incremental linear gate frontage will be available until completion of TAP Phase I in 2029. The increments of linear gate frontage available between the future baseline and completion of TAP Phase I are shown in **Table 6-2**.

Additional detail on the current project phasing and detailed depictions of each operating condition are provided in the *O'Hare 21 Project Descriptions Appendix C, Summary of Gates and Frontage* document.

CDA
CHICAGO DEPARTMENT OF AVIATION

JANUARY 2020

[DRAFT]

TABLE 6-1: GATE COUNT AND SELECTED METRICS PER GATE

| Year | Gate Count[1] | Enplaned Passengers Per Gate | Departing Seats Per Gate | Passenger Aircraft Operations Per Gate | Linear Gate Frontage (ft) |
|---|---|---|---|---|---|
| **Historical** | | | | | |
| 2006 | 186 | 204,958 | 255,032 | 4,839 | 24,770 |
| 2007 | 186 | 201,090 | 251,877 | 4,750 | 24,770 |
| 2008 | 186 | 187,581 | 238,257 | 4,516 | 24,770 |
| 2009 | 186 | 174,409 | 220,483 | 4,260 | 24,770 |
| 2010 | 186 | 177,223 | 220,277 | 4,490 | 24,770 |
| 2011 | 186 | 177,315 | 217,321 | 4,480 | 24,770 |
| 2012 | 189 | 175,884 | 211,640 | 4,441 | 24,770 |
| 2013 | 188 | 177,673 | 213,025 | 4,489 | 24,770 |
| 2014 | 188 | 186,899 | 219,274 | 4,460 | 24,770 |
| 2015 | 187 | 199,557 | 233,797 | 4,436 | 24,770 |
| 2016 | 187 | 207,410 | 242,429 | 4,412 | 24,770 |
| 2017 | 185 | 215,279 | 253,227 | 4,463 | 24,770 |
| 2018 | 191 | 217,922 | 253,868 | 4,505 | 25,305 |
| **Forecast** | | | | | |
| 2019 | 191 | 228,064 | 268,311 | 4,779 | 25,305 |
| 2020 | 191 | 233,614 | 274,840 | 4,785 | 25,305 |
| 2021 | 201-207 | 220,209 - 226,783 | 258,765 - 266,490 | 4,421 - 4,552 | 27,132 |
| 2022 | 201-207 | 224,609 - 231,314 | 263,936 - 271,814 | 4,427 - 4,559 | 27,132 |
| 2023 | 201-207 | 228,845 - 235,676 | 268,913 - 276,940 | 4,435 - 4,568 | 27,132 |
| **With TAP** | | | | | |
| 2030 | 192-219 | 279,297 – 259,058 | 285,854 – 326,052 | 5,073 – 4,446 | 30,990 |

NOTE:

1 The Terminal 5 extension project will provide flexible Multiple Aircraft Ramp System parking positions, resulting in a variable gate count

SOURCES: Federal Aviation Administration, *2018 Terminal Area Forecast*, March 2019 (converted to calendar year); US DOT Form T-100 (historical), date accessed June 2019; Ricondo & Associates, Inc. (analysis), June 2019.

TABLE 6-2: INCREMENTAL GATE CAPACITY DURING TAP CONSTRUCTION

| Condition | Net Frontage Change (linear Feet) | Cumulative Frontage (linear Feet) | Change from April 2017 (%) | Change from Future Baseline | Minimum-Maximum Gate Count |
|---|---|---|---|---|---|
| Existing (April 2017) | -- | 24,770 | -- | -- | 185 |
| Future Baseline | +2,362 | 27,132 | +9.5% | -- | 201-207 |
| End of 2024 | +644 | 27,776 | +12.1% | 2.4% | TBD |
| End of 2025 | +928 | 28,704 | +15.9% | 5.8% | TBD |
| TAP Phase I | +2,286 | 30,990 | +25.1% | 14.2% | 192-219 |

NOTE: The total airport gate count will vary depending on the size of the aircraft using each gate at a given time. Incremental changes are calculated from the preceding condition.

Source: *O'Hare 21 Project Descriptions Appendix C, Summary of Gates and Frontage*. Ricondo & Associates, Inc. (analysis), May 2019.

As shown in Table 14, the enplaned passenger per gate and operations per gate fluctuates as passenger and operational activity grows and gates are added and reconfigured. The maximum enplaned passengers per gate in Table 14 occurs in 2030. The maximum operations per gate in Table 13 occurs in 2020 or 2030 depending on the use of the minimum or maximum gate count.

# 7. Design Day Flight Schedule Methodology and Assumptions

This section describes the development and results of the O'Hare design day flight schedules (DDFS). Flight schedules were developed for the base year (2019), and two planning horizons, 2023 and 2030.

## 7.1 Design Day Flight Schedule Development

In order to develop the passenger airline DDFS, the monthly scheduled passenger airline activity levels (scheduled seat capacity and operations) for 2019 were reviewed to determine the Airport's peak month. As shown in **Table 7-1**, July was identified as the peak month for both scheduled seats and operations.

**TABLE 7-1: CY 2019 O'HARE TOTAL SCHEDULED PASSENGER AIRLINE ACTIVITY BY MONTH**

| Month | Monthly Flights | Avg. Daily Flights | Monthly Seat Capacity | Avg. Daily Seat Capacity |
|---|---|---|---|---|
| January | 69,909 | 2,255 | 7,699,385 | 248,367 |
| February | 63,763 | 2,277 | 7,011,249 | 250,402 |
| March | 73,748 | 2,379 | 8,259,383 | 266,432 |
| April | 73,302 | 2,443 | 8,260,689 | 275,356 |
| May | 77,482 | 2,499 | 8,771,642 | 282,956 |
| June | 77,880 | 2,596 | 8,948,938 | 298,298 |
| July | 80,928 | 2,611 | 9,248,077 | 298,325 |
| August | 80,873 | 2,609 | 9,157,040 | 295,388 |
| September | 76,790 | 2,560 | 8,612,971 | 287,099 |
| October | 79,604 | 2,568 | 8,913,020 | 287,517 |
| November | 74,047 | 2,468 | 8,264,078 | 275,469 |
| December | 78,020 | 2,517 | 8,657,861 | 279,286 |

SOURCES: Innovata, May 2019.

Airlines typically operate fewer flights during holidays and weekends. Due to this, the average weekday (excluding the days surrounding fourth of July holiday when weekday activity is lower than typical), was identified. As depicted in **Table 7-2**, July 24, 2019 was identified for use as the base flight schedule. The Innovata airline schedule for this date provides the airline, type of aircraft, number of seats, origin, destination, and flight times for each scheduled passenger airline flight.

TABLE 7-2: SCHEDULED O'HARE PASSENGER AIRLINE ACTIVITY – JULY 2019

| Date | Day of Week | Aircraft Operations | Seat Capacity |
|---|---|---|---|
| 1 | Monday | 2,645 | 301,016 |
| 2 | Tuesday | 2,567 | 292,135 |
| 3 | Wednesday | 2,273 | 267,000 |
| 4 | Thursday | 2,053 | 244,266 |
| 5 | Friday | 2,241 | 262,583 |
| 6 | Saturday | 2,362 | 275,691 |
| 7 | Sunday | 2,666 | 304,398 |
| 8 | Monday | 2,726 | 309,711 |
| 9 | Tuesday | 2,705 | 306,512 |
| 10 | Wednesday | 2,720 | 308,544 |
| 11 | Thursday | 2,717 | 306,966 |
| 12 | Friday | 2,730 | 310,785 |
| 13 | Saturday | 2,398 | 278,306 |
| 14 | Sunday | 2,665 | 303,941 |
| 15 | Monday | 2,727 | 309,959 |
| 16 | Tuesday | 2,705 | 306,844 |
| 17 | Wednesday | 2,717 | 308,146 |
| 18 | Thursday | 2,710 | 305,786 |
| 19 | Friday | 2,728 | 310,495 |
| 20 | Saturday | 2,395 | 277,989 |
| 21 | Sunday | 2,661 | 303,338 |
| 22 | Monday | 2,727 | 310,316 |
| 23 | Tuesday | 2,707 | 307,274 |
| 24 | Wednesday | 2,721 | 309,223 |
| 25 | Thursday | 2,718 | 307,631 |
| 26 | Friday | 2,730 | 311,060 |
| 27 | Saturday | 2,398 | 278,356 |
| 28 | Sunday | 2,662 | 303,186 |
| 29 | Monday | 2,725 | 309,982 |
| 30 | Tuesday | 2,707 | 307,068 |
| 31 | Wednesday | 2,722 | 309,570 |
| | **Total** | | |
| | Average Day (PMAD) | 2,611 | 298,325 |
| | Average Weekday (PMAWD) | 2,719 | 308,660 |

NOTE: The fourth of July holiday and dates surrounding it have excluded from the average weekday calculation.

SOURCE: Innovata, May 2019.

The number of passengers on each flight was determined by calculating the average monthly seat factor for each airline and market pairing based on July 2018 US DOT T-100 data. This airline/market seat factor was applied to the number of seats in the base schedule resulting in the number of passengers for each flight. Subsequently, O&D and connecting passenger volumes were sourced from US DOT DB1b data on an airline/market basis. Volumes were determined for each flight segment by operating airline, with flight-specific adjustments depending on the time of day (i.e., a flight departing at 5:00 a.m. would have very few connecting passengers, because it departs before most arrivals, and it is assumed passengers are not connecting overnight at ORD).

Published schedule data are not available for all-cargo and general aviation aircraft operations. The all-cargo and general aviation DDFS elements were based average day during the Airport's peak month (July). Multiple sources were used to populate these DDFS elements. These included FAA Air Traffic Activity Data Systems (ATADS), FAA Traffic Flow Management System Counts (TFMSC), and Aerobahn data for the month of July 2018. While cargo and general aviation activity peak in months other than July, the DDFSs used July activity as this month represents the total airport's peak, and provides the most representative profile of activity during the Airport's peak month average weekday.

### 7.1.1 Passenger Airline Flight Schedules

Future year DDFSs were based on the annual activity forecasts discussed in section 3. Overall assumptions used in developing the DDFSs include:

- Forecast growth for passengers and operations was based on the corresponding domestic and international annual growth rates presented in the forecasts.
- Announced new service (i.e. Delta to Boston [BOS], American to Charleston, WV [CRW]) scheduled to begin after the selected base schedule (July 24, 2019), was incorporated into the 2023 DDFS.
- Future activity growth would be accommodated through a combination of larger aircraft, new flights, and/or higher load factors

The base year DDFS was used in the progressive development of the 2023 and 2030 DDFSs. Seat factors and available seat capacity were determined through an iterative process that attempted to simulate an individual airline's changes in flight frequency and aircraft size in response to forecast growth in enplaned/deplaned passengers and aircraft operations. The steps listed below describe an overview of the schedule development process:

1. Forecasts of domestic and international passenger and aircraft operation growth rates were applied to the base year schedule in order to establish "targets" (passenger and aircraft operation levels) for each of the future DDFSs. These targets provide guidance by identifying the number of additional daily seats, passengers, and aircraft operations needed in each of the future schedules.

2. Forecast passenger growth rates from 2018 to 2023 were applied to the base schedule on a route-by-route basis. This was followed by a test calculation (run on a route-by-route basis) to determine whether forecast 2023 passenger volumes could be accommodated on base year aircraft seat capacity (i.e., was the load factor below 100 percent). If the load factor was greater than the flight-specific threshold (approximately 95 percent), the base year aircraft was either (1) increased in gauge, (2) unchanged and a new flight added to the airline-market combination, and/or (3) unchanged if the load factor was below 100 percent in order to meet forecast operations and projected fleet mix targets. If the forecast passenger growth resulted in reasonable load factors and acceptable aircraft types/sizes, the aircraft assigned in the schedule remained unchanged. In some instances, passenger growth resulted in reasonable load factors; however, the aircraft was changed to represents changes in planned airline fleets (i.e., retirement of specific aircraft).
3. In some cases, professional judgment was used to determine whether an increase in aircraft gauge and/or a new flight(s) was added to an airline-market combination. These decisions were based primarily on whether (1) each airline fleet consists of, or the airline has on order, larger gauge aircraft for the applicable DDFS period, (2) a larger gauge aircraft is available that could reasonably and effectively operate in the market, and (3) a new flight addition would be consistent with forecast growth of additional aircraft operations.
4. If an additional flight(s) was added to an existing market, passengers were redistributed across all flights in that airline-market combination. Flights added to the DDFS were matched with new flight arrivals/departures and based on typical turnaround times for the specific airline and fleet types serving the Airport. If applicable, new flights were assumed to return to their origins/destinations rather than "flowing through" to other origins and destinations. Times for additional flights to existing markets were established considering flights currently provided by the specific airline, estimates of times airline travelers would typically prefer to arrive at and depart from the Airport, and timings of connections in destination hubs (if applicable).
5. Once the 2023 DDFS was complete, the process was repeated for the 2030 DDFS.

It was assumed that aircraft gauge would not decrease in future years, unless (1) no larger gauge aircraft was available in the fleet, and (2) the new additional flight in the airline-market combination resulted in unreasonably low load factors for the combination. For example, a single daily Airbus 321 operation may have been down-gauged to an Airbus 320 when a new flight using an Airbus 319 was added to the airline-market combination. This was done in order to maintain reasonable load factors that are consistent with airline practices.

### 7.1.2 All-Cargo and General Aviation Flight Schedules

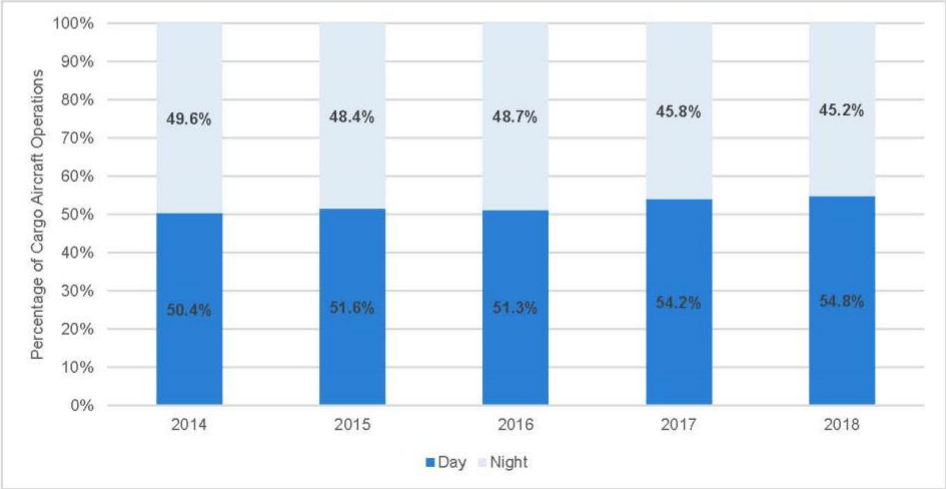
As noted, all-cargo and other air taxi/general aviation DDFSs were based on Airport and FAA data and developed in accordance with annual operational growth defined in Annual Activity Forecasts. Overall assumptions used in the all-cargo and general aviation components of the DDFSs include:

- The base year to annual ratio of operations would remain stable throughout the forecast period.

- New all-cargo and general aviation operations added in the 2023 and 2030 schedules were based on assumptions developed for the annual forecast (e.g., larger aircraft, faster international growth), and
- Specific arrival and departure times vary throughout the peak month, so representative flight times were developed instead
  - Arrival and departure times were based on a monthly average percentage of peak month operations within each block hour.
  - As an example, 10 percent of all-cargo arrivals occur during the 22:00 to 22:59 block hour during the peak month. If there are 20 all-cargo aircraft arriving in the DDFS, 2 arrivals (20 arrivals x 10 percent) were assigned to the corresponding block hour

Arrival and departure times for new flights were based on the average monthly percentage of all cargo or general aviation flights during peak month (July) operations in the block hour, as reported from Aerobahn. This entailed a staggered distribution of arrival and departures times within the block hour since air taxi/general aviation times in the Airport data varied significantly. **Table 7-3** and **Table 7-4** provide the percentage of block hour operations conducted during the month of July for cargo and general aviation activity, respectively. Shown alongside of this is the number of flights allocated in the DDFS during a given block. In some cases, the percentage in a given block hour results in less than a whole aircraft operation, and as a result, the number of operations shown in the DDFS may not equal the observed percentage over the course of the month. When this occurred, flights were allocated based on professional judgement, with an effort to allocate the aircraft operation to a night time block hour. For the purposes of these analyses, day is defined as 07:00-21:59 and night is defined as 22:00-06:59. The distribution day time and night time cargo aircraft flights over the past five years was evaluated. The percentage of night time activity has varied from 49.6 percent in 2014 to 45.2 percent in 2018, as shown in **Exhibit 7-1**. The ratio of day-to-night cargo and general aviation flights was modelled to remain constant over the forecast period.

EXHIBIT 7-1: CARGO AIRCRAFT DAY AND NIGHT OPERATIONS




SOURCE: Aerobahn, August 2019.

## 7.2 Design Day Flight Schedule Results

### 7.2.1 Enplaned Passenger Results

The annual and DDFS total (two-way) passenger volumes for the base year, 2023, and 2030 schedules are shown in **Table 7-5**. Rolling hour profiles of O&D passengers, connecting passengers and total passengers are presented in **Exhibit 7-2**, **Exhibit 7-3**, and **Exhibit 7-4** respectively.

Block hour enplaned and deplaned passenger activity is presented in **Table 7-6**.

TABLE 7-3: JULY BLOCK HOUR OPERATIONS ALLOCATIONS – CARGO AIRLINES

| Block Hour | Day/Night | Monthly Arrivals | Monthly Departures | DDFS Arrivals | DDFS Departures |
|---|---|---|---|---|---|
| 0 | Night | 4.7% | 1.9% | 1 | 2 |
| 1 | Night | 2.4% | 4.3% | 0 | 1 |
| 2 | Night | 0.8% | 8.0% | 1 | 2 |
| 3 | Night | 4.1% | 4.2% | 2 | 0 |
| 4 | Night | 10.0% | 2.6% | 4 | 0 |
| 5 | Night | 6.8% | 0.8% | 3 | 1 |
| 6 | Night | 2.7% | 2.5% | 5 | 0 |
| 7 | Day | 2.4% | 4.3% | 3 | 0 |
| 8 | Day | 4.1% | 3.5% | 1 | 2 |
| 9 | Day | 4.6% | 1.3% | 0 | 0 |
| 10 | Day | 4.4% | 1.6% | 1 | 0 |
| 11 | Day | 2.8% | 3.6% | 1 | 0 |
| 12 | Day | 2.4% | 3.2% | 0 | 1 |
| 13 | Day | 2.9% | 3.2% | 0 | 2 |
| 14 | Day | 3.1% | 3.3% | 0 | 1 |
| 15 | Day | 2.9% | 2.1% | 0 | 0 |
| 16 | Day | 5.6% | 3.5% | 0 | 0 |
| 17 | Day | 5.6% | 3.2% | 1 | 1 |
| 18 | Day | 3.6% | 3.3% | 2 | 1 |
| 19 | Day | 4.9% | 3.3% | 0 | 2 |
| 20 | Day | 3.1% | 3.9% | 1 | 0 |
| 21 | Day | 3.1% | 8.6% | 1 | 3 |
| 22 | Night | 4.3% | 10.1% | 1 | 4 |
| 23 | Night | 8.8% | 13.5% | 4 | 9 |
| **TOTAL** | | **100%** | **100%** | **32** | **32** |
| Day | | 55.5% | 51.9% | 11 | 13 |
| Night | | 44.6% | 47.9% | 21 | 19 |

NOTE: The percentages shown are for the entire month of July, while the operations reflect what is included in the DDFS.
SOURCE: Aerobahn, June 2019.

TABLE 7-4: JULY BLOCK HOUR OPERATIONS ALLOCATIONS – GENERAL AVIATION

| Block Hour | Day/Night | Monthly Arrivals | Monthly Departures | DDFS Arrivals | DDFS Departures |
|---|---|---|---|---|---|
| 0 | Night | 0.0% | 0.0% | 0 | 0 |
| 1 | Night | 0.3% | 0.3% | 0 | 0 |
| 2 | Night | 0.8% | 0.3% | 0 | 0 |
| 3 | Night | 0.3% | 0.3% | 0 | 0 |
| 4 | Night | 0.8% | 0.3% | 0 | 0 |
| 5 | Night | 0.5% | 0.0% | 1 | 0 |
| 6 | Night | 2.7% | 2.2% | 0 | 0 |
| 7 | Day | 5.6% | 2.9% | 0 | 0 |
| 8 | Day | 5.6% | 5.4% | 1 | 1 |
| 9 | Day | 5.4% | 4.8% | 1 | 1 |
| 10 | Day | 4.8% | 3.2% | 1 | 1 |
| 11 | Day | 6.7% | 9.6% | 1 | 1 |
| 12 | Day | 7.8% | 6.1% | 1 | 1 |
| 13 | Day | 9.1% | 6.7% | 1 | 1 |
| 14 | Day | 7.5% | 9.3% | 1 | 1 |
| 15 | Day | 11.3% | 13.4% | 0 | 1 |
| 16 | Day | 9.4% | 7.7% | 0 | 0 |
| 17 | Day | 6.2% | 7.7% | 0 | 0 |
| 18 | Day | 6.7% | 3.8% | 0 | 0 |
| 19 | Day | 2.2% | 5.1% | 0 | 0 |
| 20 | Day | 2.2% | 5.4% | 0 | 0 |
| 21 | Day | 1.6% | 1.6% | 0 | 0 |
| 22 | Night | 1.9% | 2.2% | 0 | 0 |
| 23 | Night | 0.5% | 1.6% | 0 | 0 |
| **TOTAL** | | **100%** | **100%** | **8** | **8** |
| Day | | 92.1% | 92.7% | 7 | 8 |
| Night | | 7.8% | 7.2% | 1 | 0 |

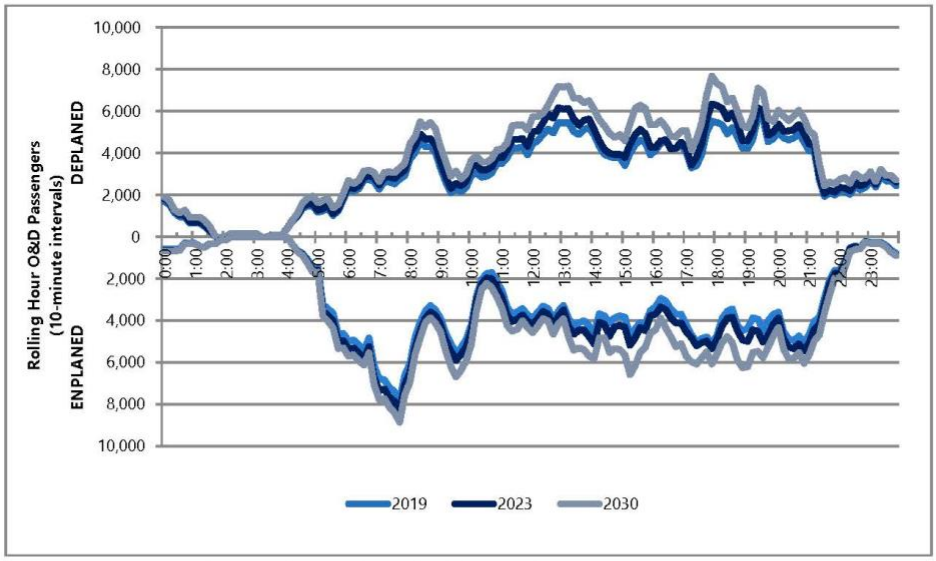
NOTE: The percentages shown are for the entire month of July, while the operations reflect what is included in the DDFS.
SOURCE: Aerobahn, June 2019.

TABLE 7-5: ANNUAL AND DDFS TOTAL PASSENGERS

| Year | DDFS | Annual | Ratio |
|---|---|---|---|
| 2019 | 280,427 | 87,120,580 | 0.322% |
| 2023 | 305,193 | 94,741,685 | 0.322% |
| 2030 | 344,901 | 107,250,084 | 0.322% |
| **Compound Annual Growth Rate** | | | |
| 2019-2023 | 2.1% | 2.1% | |
| 2019-2030 | 1.9% | 1.9% | |

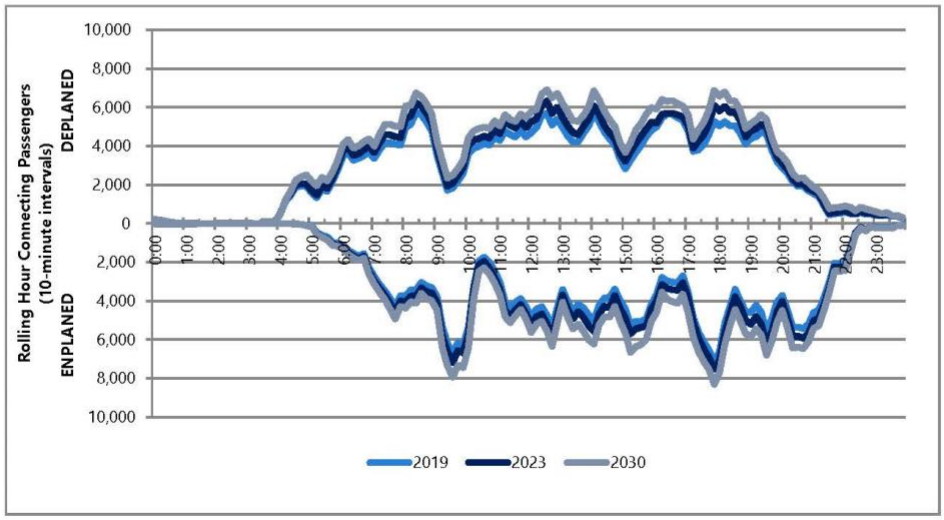
SOURCES: US DOT Form T-100; Ricondo & Associates, Inc. (analysis), August 2019.

EXHIBIT 7-2: ROLLING HOUR O&D PASSENGER ACTIVITY



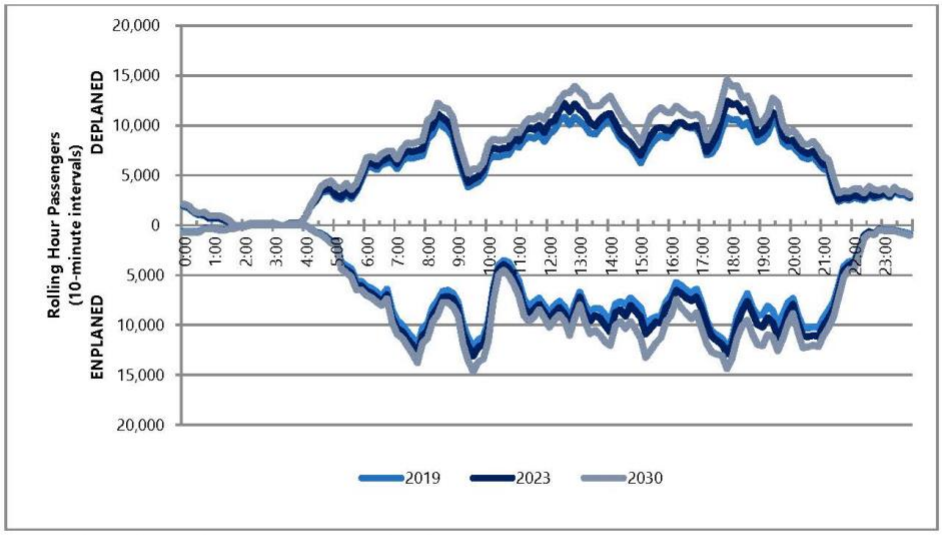

SOURCES: US DOT Form T-100; Ricondo & Associates, Inc. (analysis), August 2019.

EXHIBIT 7-3: ROLLING HOUR CONNECTING PASSENGER ACTIVITY




SOURCES: US DOT Form T-100; Ricondo & Associates, Inc. (analysis), August 2019.

EXHIBIT 7-4: ROLLING HOUR TOTAL PASSENGER ACTIVITY




SOURCES: US DOT Form T-100; Ricondo & Associates, Inc. (analysis), August 2019.

TABLE 7-6: HOURLY SUMMARY – ENPLANED PASSENGERS

| Time of Day (Hourly) | 2019 Enplaned Passengers | 2019 Deplaned Passengers | 2019 Total Passengers | 2023 Enplaned Passengers | 2023 Deplaned Passengers | 2023 Total Passengers | 2030 Enplaned Passengers | 2030 Deplaned Passengers | 2030 Total Passengers |
|---|---|---|---|---|---|---|---|---|---|
| 0:00 - 0:59 | 1,866 | 606 | 2,472 | 2,015 | 680 | 2,695 | 2,108 | 686 | 2,794 |
| 1:00 - 1:59 | 660 | 333 | 993 | 728 | 351 | 1,078 | 951 | 351 | 1,302 |
| 2:00 - 2:59 | 0 | 144 | 144 | 0 | 149 | 149 | 0 | 159 | 159 |
| 3:00 - 3:59 | 148 | 0 | 148 | 169 | 0 | 169 | 180 | 0 | 180 |
| 4:00 - 4:59 | 846 | 0 | 846 | 889 | 0 | 889 | 843 | 0 | 843 |
| 5:00 - 5:59 | 2,767 | 1,548 | 4,315 | 2,983 | 1,697 | 4,680 | 3,829 | 1,788 | 5,617 |
| 6:00 - 6:59 | 5,778 | 6,104 | 11,882 | 6,163 | 6,593 | 12,755 | 6,766 | 7,014 | 13,780 |
| 7:00 - 7:59 | 5,640 | 9,528 | 15,168 | 6,138 | 10,321 | 16,459 | 6,640 | 10,906 | 17,546 |
| 8:00 - 8:59 | 8,644 | 9,830 | 18,474 | 9,418 | 10,527 | 19,945 | 10,515 | 11,323 | 21,838 |
| 9:00 - 9:59 | 6,803 | 7,665 | 14,468 | 7,389 | 8,269 | 15,657 | 8,533 | 9,031 | 17,564 |
| 10:00 - 10:59 | 6,538 | 9,578 | 16,116 | 7,350 | 10,189 | 17,539 | 8,089 | 11,586 | 19,674 |
| 11:00 - 11:59 | 7,806 | 5,591 | 13,397 | 8,426 | 6,301 | 14,726 | 9,258 | 7,087 | 16,345 |
| 12:00 - 12:59 | 9,145 | 8,718 | 17,863 | 10,264 | 9,469 | 19,733 | 11,512 | 10,203 | 21,715 |
| 13:00 - 13:59 | 10,407 | 6,697 | 17,104 | 11,577 | 7,177 | 18,754 | 13,359 | 7,979 | 21,338 |
| 14:00 - 14:59 | 10,571 | 9,578 | 20,149 | 11,210 | 10,696 | 21,906 | 12,933 | 12,036 | 24,968 |
| 15:00 - 15:59 | 6,240 | 8,280 | 14,520 | 7,008 | 9,210 | 16,217 | 8,272 | 11,305 | 19,577 |
| 16:00 - 16:59 | 9,147 | 7,013 | 16,160 | 9,463 | 7,699 | 17,162 | 11,278 | 9,020 | 20,298 |
| 17:00 - 17:59 | 8,826 | 7,768 | 16,594 | 9,269 | 8,392 | 17,660 | 10,694 | 10,319 | 21,013 |
| 18:00 - 18:59 | 10,507 | 11,377 | 21,884 | 12,086 | 11,955 | 24,041 | 13,914 | 13,307 | 27,222 |
| 19:00 - 19:59 | 8,616 | 8,955 | 17,571 | 9,370 | 10,191 | 19,561 | 10,373 | 12,071 | 22,444 |
| 20:00 - 20:59 | 7,913 | 7,321 | 15,234 | 8,508 | 7,908 | 16,415 | 9,529 | 8,834 | 18,364 |
| 21:00 - 21:59 | 5,661 | 9,286 | 14,947 | 6,092 | 10,081 | 16,173 | 6,921 | 11,066 | 17,987 |
| 22:00 - 22:59 | 2,763 | 3,647 | 6,410 | 3,026 | 4,003 | 7,029 | 3,648 | 4,429 | 8,077 |
| 23:00 - 23:59 | 3,094 | 474 | 3,568 | 3,270 | 530 | 3,800 | 3,702 | 554 | 4,256 |
| **Total** | **140,386** | **140,041** | **280,427** | **152,809** | **152,385** | **305,193** | **173,846** | **171,055** | **344,901** |
| Peak Block Hour | 10,571 | 11,377 | 21,884 | 12,086 | 11,955 | 24,041 | 13,914 | 13,307 | 27,222 |
| Peak Rolling Hour (10-minute intervals) | 10,845 | 12,271 | 23,027 | 12,453 | 13,090 | 25,324 | 14,563 | 14,633 | 28,938 |

SOURCES: Innovata, Ricondo & Associates, Inc. (analysis), August 2019.

### 7.2.2 Aircraft Operations Results

The annual and DDFS passenger aircraft and non-passenger aircraft operations volumes for the base year, 2023, and 2030 schedules are shown in **Table 7-7** and **Table 7-8**, respectively. Rolling hour profiles of passenger aircraft and total aircraft operations are presented in **Exhibit 7-5** and **Exhibit 7-6** respectively.

Block hour total aircraft operations are presented in **Table 7-9**.

**TABLE 7-7: ANNUAL AND DDFS PASSENGER AIRLINE OPERATIONS**

| Year | DDFS | Annual | Ratio |
|---|---|---|---|
| 2019 | 2,720 | 914,712 | 0.297% |
| 2023 | 2,734 | 918,075 | 0.298% |
| 2030 | 2,889 | 973,592 | 0.297% |
| **Compound Annual Growth Rate** | | | |
| 2019-2023 | 0.1% | 0.1% | |
| 2019-2030 | 0.5% | 0.6% | |

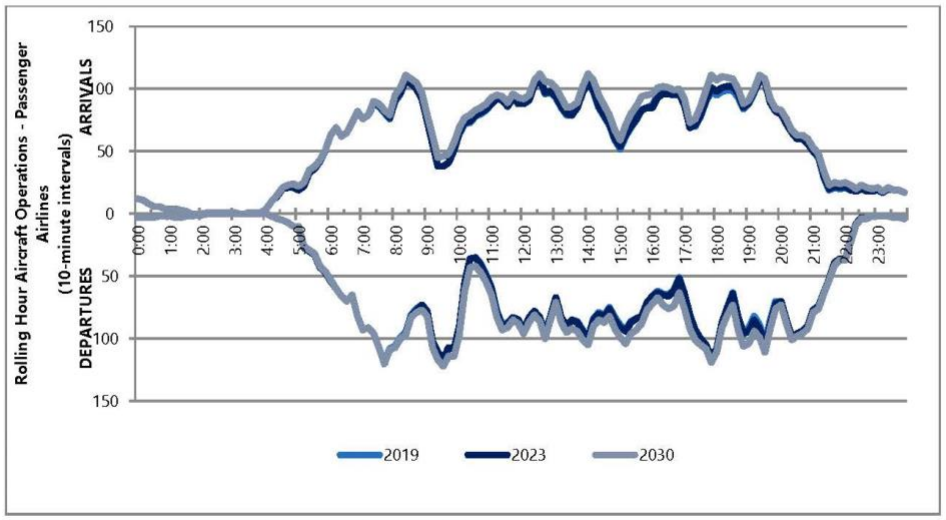
SOURCES: Innovata, Ricondo & Associates, Inc. (analysis), August 2019.

**TABLE 7-8: NON-PASSENGER AIRLINE AND TOTAL AIRPORT AIRCRAFT OPERATIONS**

| Year | Cargo | General Aviation | Military | Non-Passenger Airline Total | Passenger Airline Total | Airport Total |
|---|---|---|---|---|---|---|
| **DDFS Operations** | | | | | | |
| 2019 | 64 | 16 | 0 | 80 | 2,720 | 2,800 |
| 2023 | 70 | 16 | 0 | 86 | 2,734 | 2,820 |
| 2030 | 88 | 16 | 0 | 104 | 2,889 | 2,993 |
| **Annual Operations** | | | | | | |
| 2019 | 25,878 | 5,906 | 75 | 31,859 | 914,712 | 946,571 |
| 2023 | 28,433 | 5,906 | 74 | 34,413 | 918,075 | 952,489 |
| 2030 | 34,283 | 5,906 | 74 | 40,263 | 973,592 | 1,013,856 |
| **DDFS to Annual Operations Ratio** | | | | | | |
| 2019 | 0.247% | 0.271% | 0.000% | 0.251% | 0.297% | 0.296% |
| 2023 | 0.246% | 0.271% | 0.000% | 0.250% | 0.298% | 0.296% |
| 2030 | 0.257% | 0.271% | 0.000% | 0.258% | 0.297% | 0.295% |

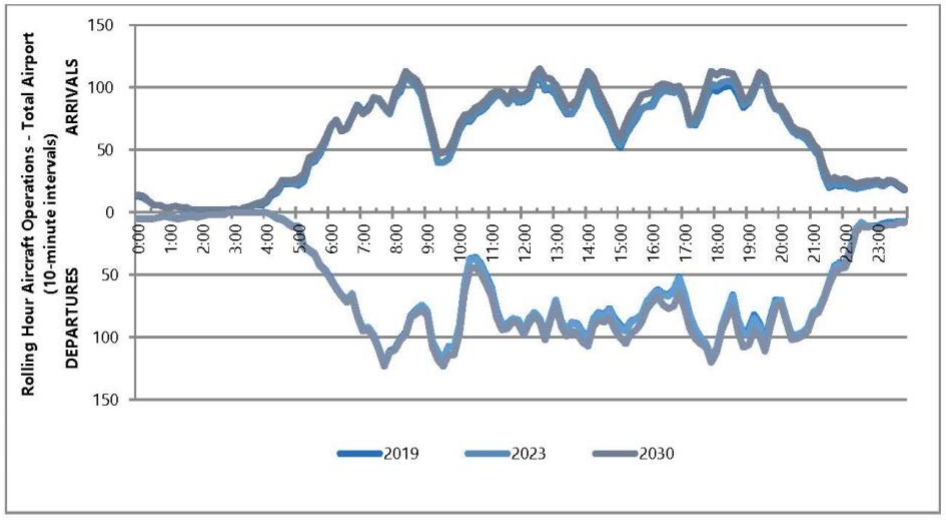
SOURCES: Innovata, Ricondo & Associates, Inc. (analysis), August 2019.

EXHIBIT 7-5: ROLLING HOUR PASSENGER AIRCRAFT OPERATIONS




SOURCES: Innovata; Ricondo & Associates, Inc. (analysis), August 2019.

EXHIBIT 7-6: ROLLING HOUR TOTAL AIRCRAFT OPERATIONS




SOURCES: Innovata; Ricondo & Associates, Inc. (analysis), August 2019.

TABLE 7-9: HOURLY SUMMARY – TOTAL AIRCRAFT OPERATIONS

| Time of Day (Hourly) | 2019 Arrivals | 2019 Departures | 2019 Total | 2023 Arrivals | 2023 Departures | 2023 Total | 2030 Arrivals | 2030 Departures | 2030 Total |
|---|---|---|---|---|---|---|---|---|---|
| 0:00 - 0:59 | 13 | 5 | 18 | 14 | 5 | 19 | 14 | 5 | 19 |
| 1:00 - 1:59 | 4 | 3 | 7 | 4 | 3 | 7 | 4 | 4 | 8 |
| 2:00 - 2:59 | 1 | 3 | 4 | 1 | 3 | 4 | 2 | 3 | 5 |
| 3:00 - 3:59 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 |
| 4:00 - 4:59 | 8 | 0 | 8 | 9 | 0 | 9 | 10 | 0 | 10 |
| 5:00 - 5:59 | 22 | 11 | 33 | 23 | 11 | 34 | 27 | 12 | 39 |
| 6:00 - 6:59 | 68 | 53 | 121 | 68 | 54 | 122 | 69 | 55 | 124 |
| 7:00 - 7:59 | 80 | 93 | 173 | 79 | 93 | 172 | 79 | 95 | 174 |
| 8:00 - 8:59 | 92 | 109 | 201 | 92 | 110 | 202 | 96 | 110 | 206 |
| 9:00 - 9:59 | 75 | 79 | 154 | 75 | 79 | 154 | 80 | 83 | 163 |
| 10:00 -10:59 | 66 | 91 | 157 | 67 | 91 | 158 | 71 | 98 | 169 |
| 11:00 - 11:59 | 90 | 60 | 150 | 90 | 62 | 152 | 95 | 67 | 162 |
| 12:00 - 12:59 | 89 | 95 | 184 | 90 | 95 | 185 | 94 | 98 | 192 |
| 13:00 - 13:59 | 94 | 70 | 164 | 95 | 70 | 165 | 102 | 74 | 176 |
| 14:00 - 14:59 | 106 | 101 | 207 | 106 | 102 | 208 | 113 | 107 | 220 |
| 15:00 - 15:59 | 52 | 90 | 142 | 54 | 92 | 146 | 59 | 100 | 159 |
| 16:00 - 16:59 | 87 | 66 | 153 | 85 | 66 | 151 | 96 | 72 | 168 |
| 17:00 - 17:59 | 89 | 65 | 154 | 88 | 65 | 153 | 93 | 77 | 170 |
| 18:00 - 18:59 | 97 | 111 | 208 | 101 | 109 | 210 | 110 | 112 | 222 |
| 19:00 - 19:59 | 88 | 93 | 181 | 89 | 96 | 185 | 92 | 106 | 198 |
| 20:00 - 20:59 | 81 | 70 | 151 | 81 | 70 | 151 | 85 | 73 | 158 |
| 21:00 - 21:59 | 51 | 80 | 131 | 51 | 80 | 131 | 55 | 83 | 138 |
| 22:00 - 22:59 | 22 | 40 | 62 | 23 | 40 | 63 | 27 | 44 | 71 |
| 23:00 - 23:59 | 23 | 11 | 34 | 23 | 13 | 36 | 26 | 13 | 39 |
| Total | **1,401** | **1,399** | **2,800** | **1,411** | **1,409** | **2,820** | **1,502** | **1,491** | **2,993** |
| Peak Block Hour | 106 | 111 | 208 | 106 | 110 | 210 | 113 | 112 | 222 |
| Peak Rolling Hour (10-minute intervals) | 109 | 122 | 218 | 111 | 122 | 219 | 115 | 123 | 233 |

SOURCES: Innovata, Ricondo & Associates, Inc. (analysis), August 2019.

The DDFS passenger aircraft and cargo aircraft operations fleet mix were based on the factors described in section 3, and are provided in **Table 7-10** and **Table 7-11**, respectively.

**TABLE 7-10: PASSENGER AIRCRAFT OPERATIONS FLEET MIX**

| Year | Regional/ Commuter | Narrowbody | Widebody | Total |
|---|---|---|---|---|
| **Passenger Aircraft Operations** | | | | |
| 2019 | 1,439 | 1,131 | 150 | 2,720 |
| 2023 | 1,420 | 1,122 | 192 | 2,734 |
| 2030 | 1,454 | 1,221 | 214 | 2,889 |
| **Share of Passenger Aircraft Operations** | | | | |
| 2019 | 53% | 42% | 6% | 100% |
| 2023 | 52% | 41% | 7% | 100% |
| 2030 | 50% | 42% | 7% | 100% |
| **Average Seats per Departure** | | | | |
| 2019 | 59.0 | 160.8 | 282.7 | 113.7 |
| 2023 | 60.1 | 168.7 | 293.5 | 121.0 |
| 2030 | 63.6 | 175.2 | 301.9 | 128.4 |

SOURCES: Innovata, Ricondo & Associates, Inc. (analysis), August 2019.

**TABLE 7-11: CARGO AIRCRAFT OPERATIONS FLEET MIX**

| Year | Regional/ Commuter | Narrowbody | Widebody | Total |
|---|---|---|---|---|
| **Cargo Aircraft Operations** | | | | |
| 2019 | 0 | 2 | 62 | 64 |
| 2023 | 0 | 4 | 66 | 70 |
| 2030 | 0 | 6 | 82 | 88 |
| **Share of Cargo Aircraft Operations** | | | | |
| 2019 | 0% | 3% | 97% | 100% |
| 2023 | 0% | 6% | 94% | 100% |
| 2030 | 0% | 7% | 93% | 100% |

SOURCES: US DOT T-100, Ricondo & Associates, Inc. (analysis), August 2019.

# 8. Constrained Schedule Analysis

A gating analysis of the draft 2030 Design Day Flight Schedule (DDFS) was performed to determine whether a constrained schedule should be explored for the 2030 No Action scenario.

The gating analysis considered factors such as airline/gate allocation, gate gauge, aircraft turn times, and gate separation times (time between a gate departure and subsequent gate arrival). The following assumptions were used for the analysis of the 2030 No Action scenario.

## 8.1 Gate Layout, Gate Gauge, and Airline Allocation

**Exhibit 8-1** shows the gate layout, gate gauge, and airline allocation assumed in the 2030 No Action gating scenario. The following gate changes were assumed to have occurred between July 2019 and 2030:

- The Terminal 5 Concourse M Extension is complete and operational
- The Terminal 3 Concourse L 2-gate expansion is complete and operational
- The Concourse L/Concourse G gate swap has occurred, allocating the entirety of Concourse L to American and the west side of Concourse G to Alaska, Spirit Airlines (Spirit), and CDA Common Use.
- Delta Air Lines (Delta) and the EAS operators have moved to the north portion of Terminal 5 Concourse M.

## 8.2 Aircraft Turn Times

Aircraft turn times utilized for this analysis were obtained from the matched draft 2030 DDFS.

## 8.3 Gate Separation, Tow-On, and Tow-Off Times

**Table 8-1** and **Table 8-2** outline the minimum time-at-gate for domestic and international operations, respectively, used in the gating exercise. The minimum time-at-gate ranges from 30 minutes for a domestic Regional Jet to 105 minutes for an ADG-VI international operation.

Gate separation times, or time when a gate is empty between a departure and successive arrival, were assumed to be 10 minutes for aircraft using common use international gates (based on existing schedule activity), 20 minutes for narrowbody aircraft using preferential use gates, and 30 minutes for widebody aircraft using preferential use gates. 20 minutes of gate separation was used between tow-on and/or tow-off operations at preferential use gates.

EXHIBIT 8-1: NO ACTION – FULL BUILD GATE LAYOUT

TABLE 8-1: MINIMUM TIME AT GATE (DOMESTIC OPERATIONS)

| Aircraft Size | Minimum Time at Gate After Arrival (Arrival + Tow-OFF) | Minimum Time at Gate before Departure (Tow-ON + Departure) |
|---|---|---|
| Regional Jet | 30 minutes | 30 minutes |
| ADG-III | 40 minutes | 40 minutes |
| ADG-IV | 40 minutes | 40 minutes |
| ADG-V | 60 minutes | 90 minutes |
| ADG-VI | 60 minutes | 90 minutes |

SOURCE: Ricondo & Associates, Inc., July 2019.

TABLE 8-2: MINIMUM TIME AT GATE (INTERNATIONAL OPERATIONS)

| Aircraft Size | Minimum Time at Gate After Arrival (Arrival + Tow-OFF) | Minimum Time at Gate before Departure (Tow-ON + Departure) |
|---|---|---|
| Regional Jet | 45 minutes | 45 minutes |
| ADG-III | 45 minutes | 45 minutes |
| ADG-IV | 60 minutes | 75 minutes |
| ADG-V | 60 minutes | 90 minutes |
| ADG-VI | 75 minutes | 105 minutes |

SOURCE: Ricondo & Associates, Inc., July 2019.

## 8.4 Gating Summary

**Appendix A** contains the gating output of the 2030 No Action scenario in Gantt chart format. Gate numbers are shown on the left side of the chart and time of day is shown along the top. All flights were able to be gated successfully without hard standing for enplaning or deplaning passengers. However, gate separation times and minimum times at gate needed to be reduced in certain instances to accommodate all flights. Airline scheduling practices suggest that it is reasonable to assume these modifications could occur to accommodate a peak summer schedule.

### *Modifications to Gate Separation Times*

- There were 45 instances at Terminals 1, 2, and 3 where gate separation times were reduced below 20 minutes. Of those 45 instances, there were 3 instances where gate separation times were reduced below 10 minutes.
- There were 4 instances at Terminal 5 where gate separation times were reduced below 10 minutes.

### *Modifications to Minimum Time at Gate*

- There were no instances at Terminals 1, 2, and 3 where minimum time at gate after arrival (arrival + tow-off) was reduced below the minimums recommended in Tables 15 and 16.
- There were 6 instances at Terminals 1, 2, and 3 where minimum time at gate before departure (tow-on + departure) was reduced below the minimums recommended in Tables 15 and 16.
- There was 1 instance at Terminal 5 where minimum time at gate after arrival (arrival + tow-off) was reduced below the minimums recommended in Tables 15 and 16.
- There were no instances at Terminal 5 where minimum time at gate before departure (tow-on + departure) was reduced below the minimums recommended in Tables 15 and 16.

Additionally, a total of 168 tow-on and tow-off movements were required, with 55 of those tow movements being from Terminal 5 to Terminals 1, 2, and 3 to accommodate international arrivals for United and American. A peak remote aircraft parking requirement of 20 positions (11 for United, 7 for American, and 2 for Spirit) is needed to accommodate aircraft towed off gates at Terminals 1, 2, and 3. This requirement could be accommodated on existing facilities in the Northwest Maintenance Hangar Area and the Centralized Deicing Facility. A peak remote aircraft parking requirement of 4 positions (3 for Delta, 1 for other airlines) is needed to accommodate aircraft towed off gates at Terminal 5. This requirement could be accommodated on the hardstand area east of the Terminal 5 Concourse M Extension.

Without consideration for other factors such as aircraft delay, the gating analysis of the draft 2030 DDFS for the 2030 No Action scenario indicates that a constrained schedule would not be necessary.

CDA
CHICAGO DEPARTMENT OF AVIATION

JANUARY 2020

[DRAFT]

# Appendix A Gated 2030 Flight Schedule

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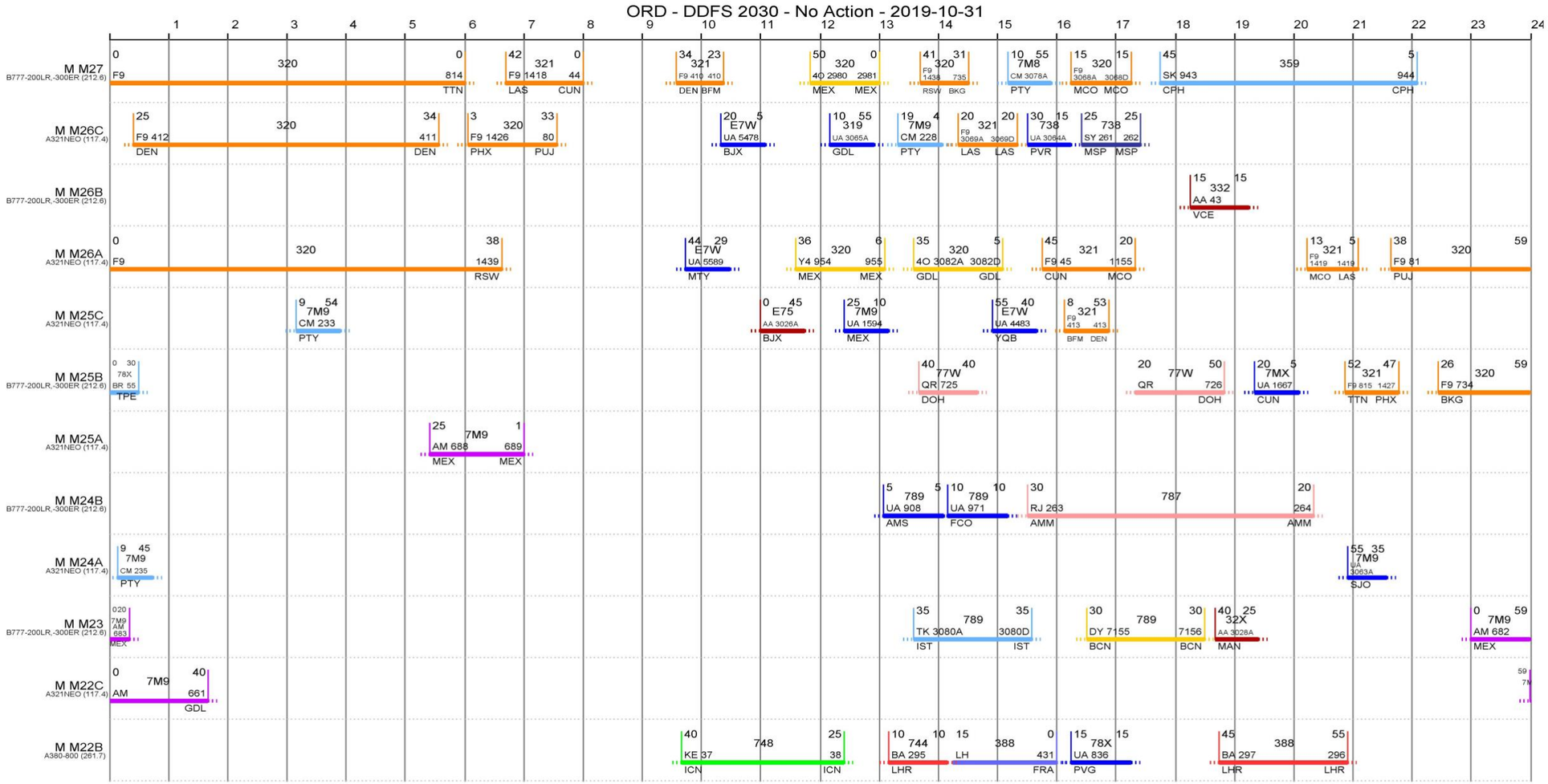


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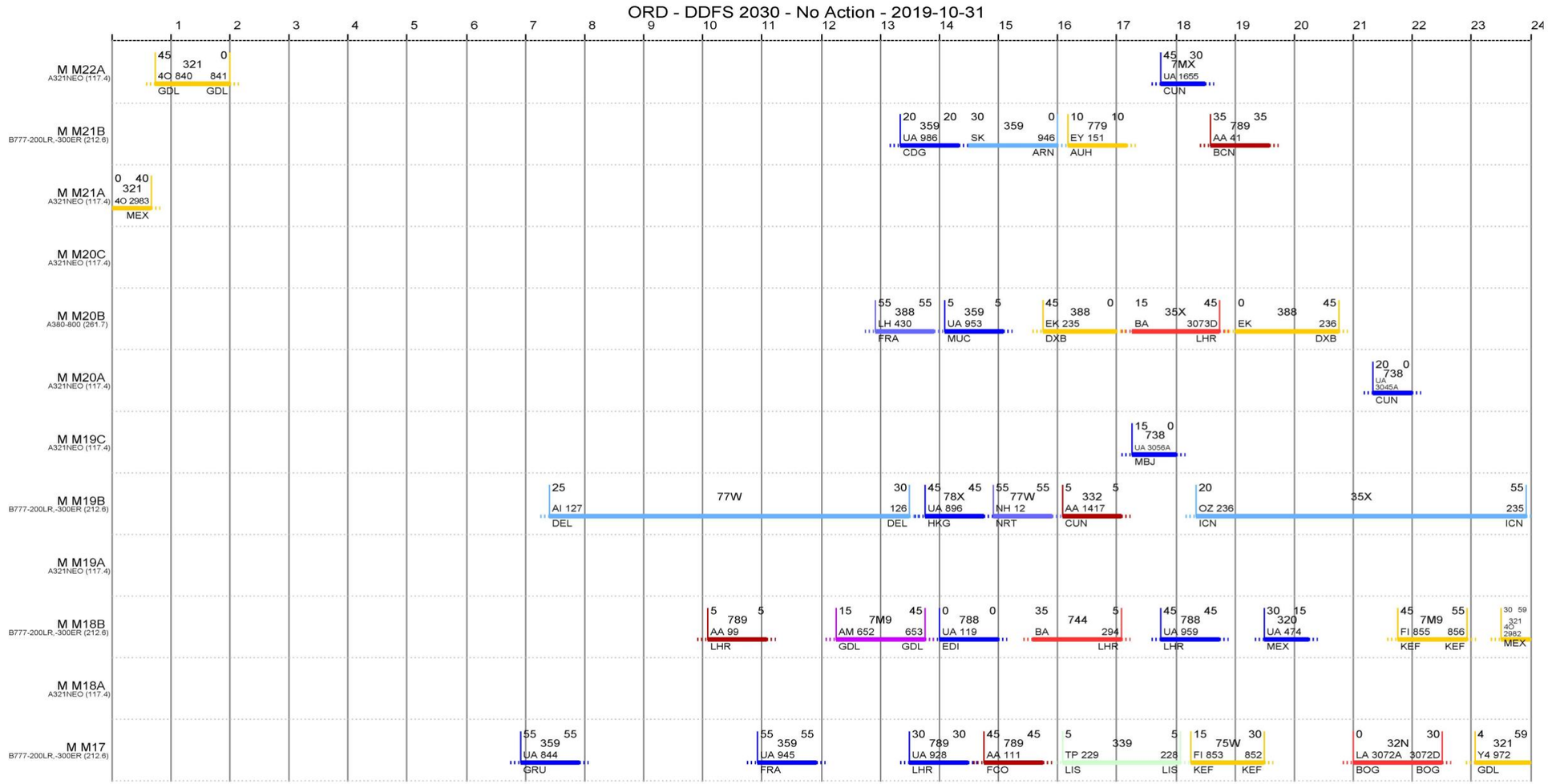


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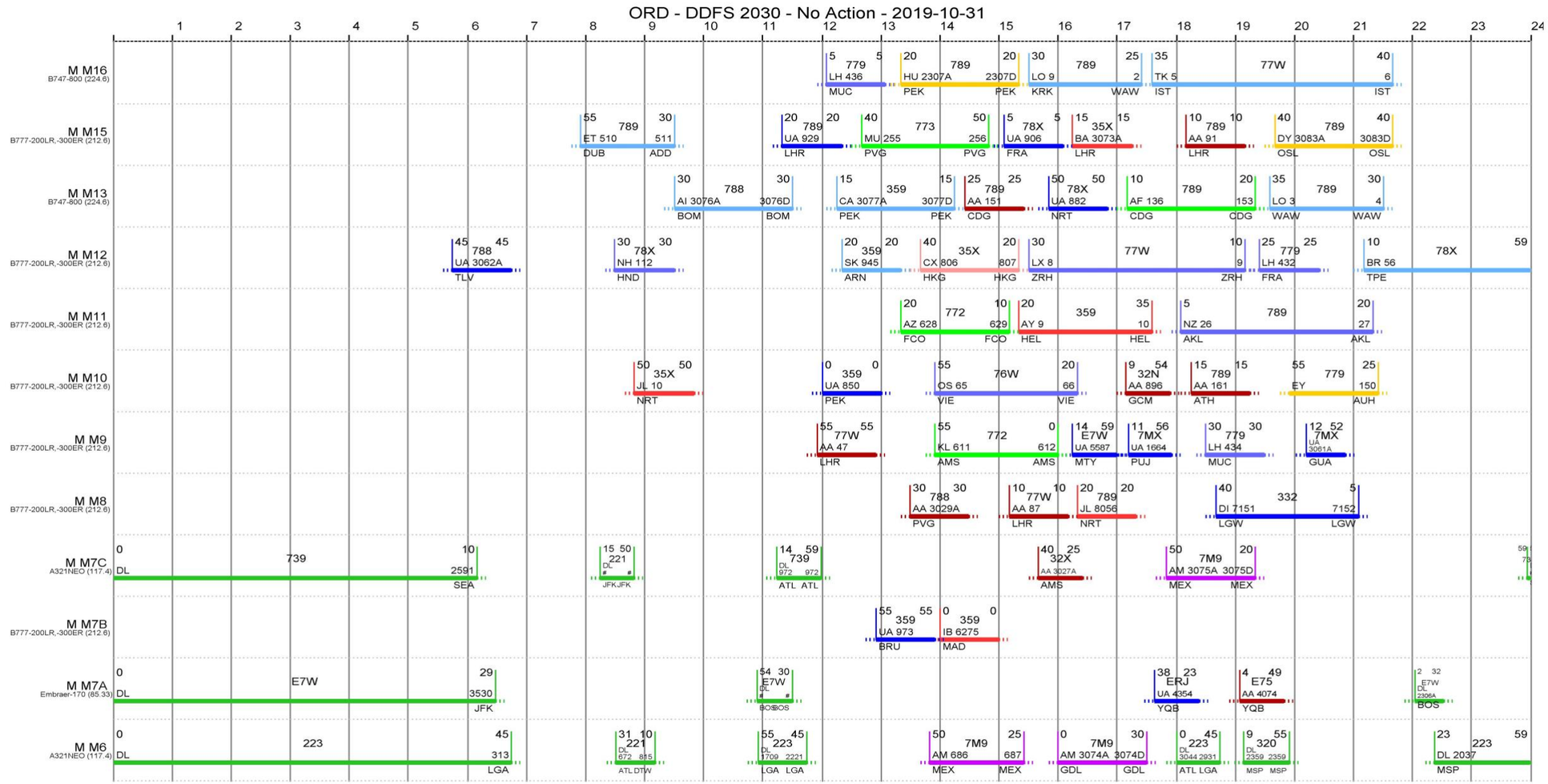

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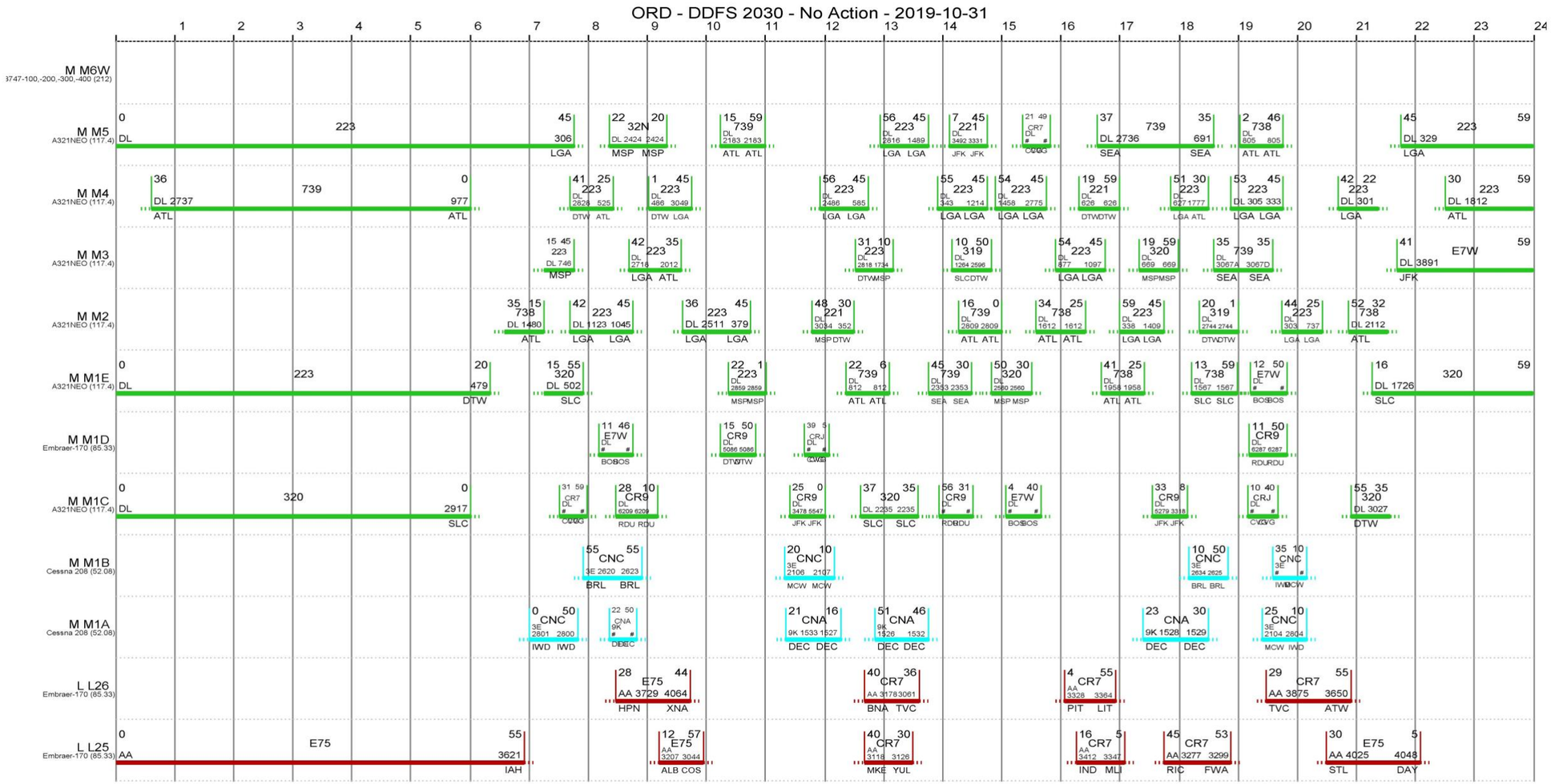

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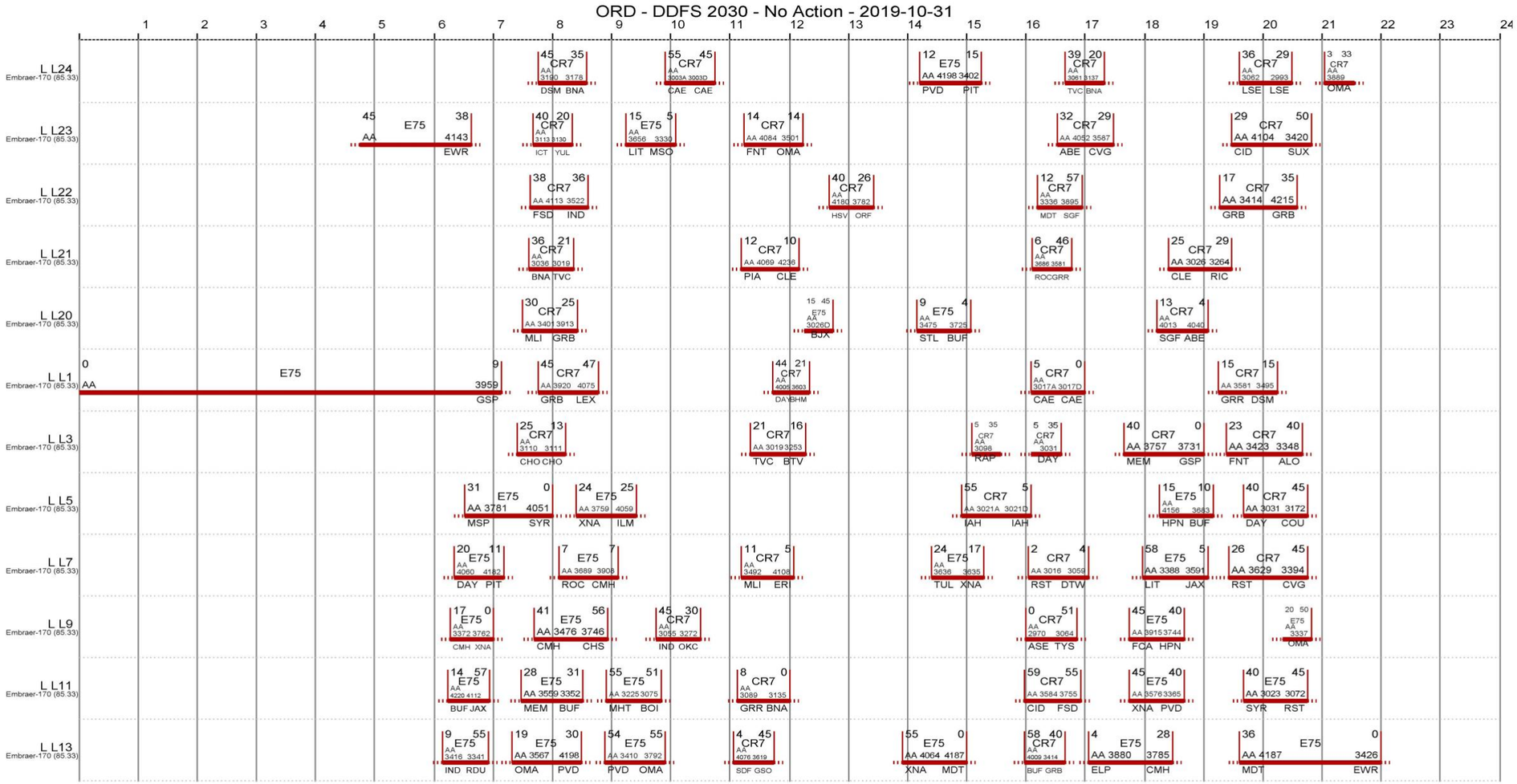

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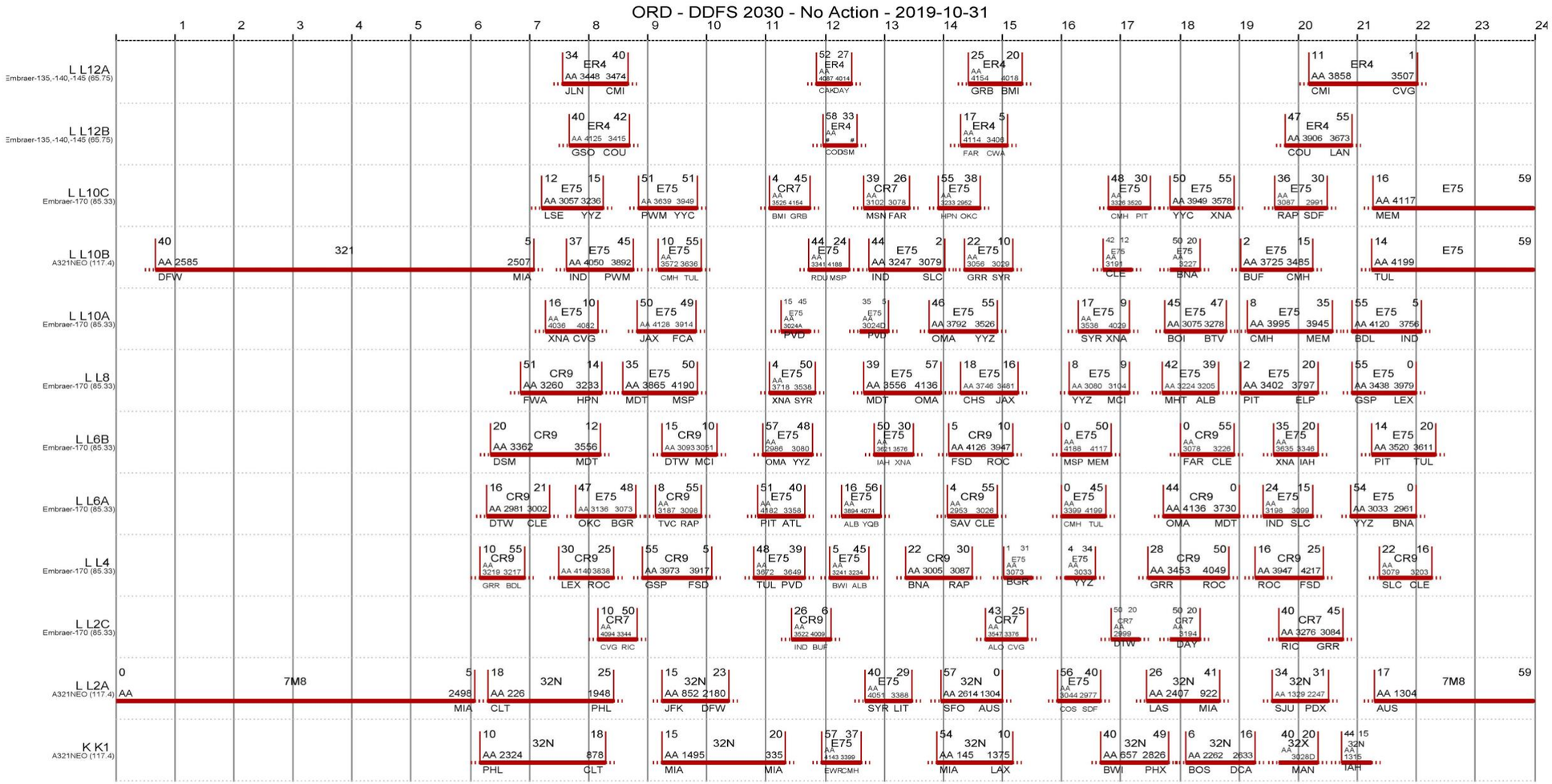

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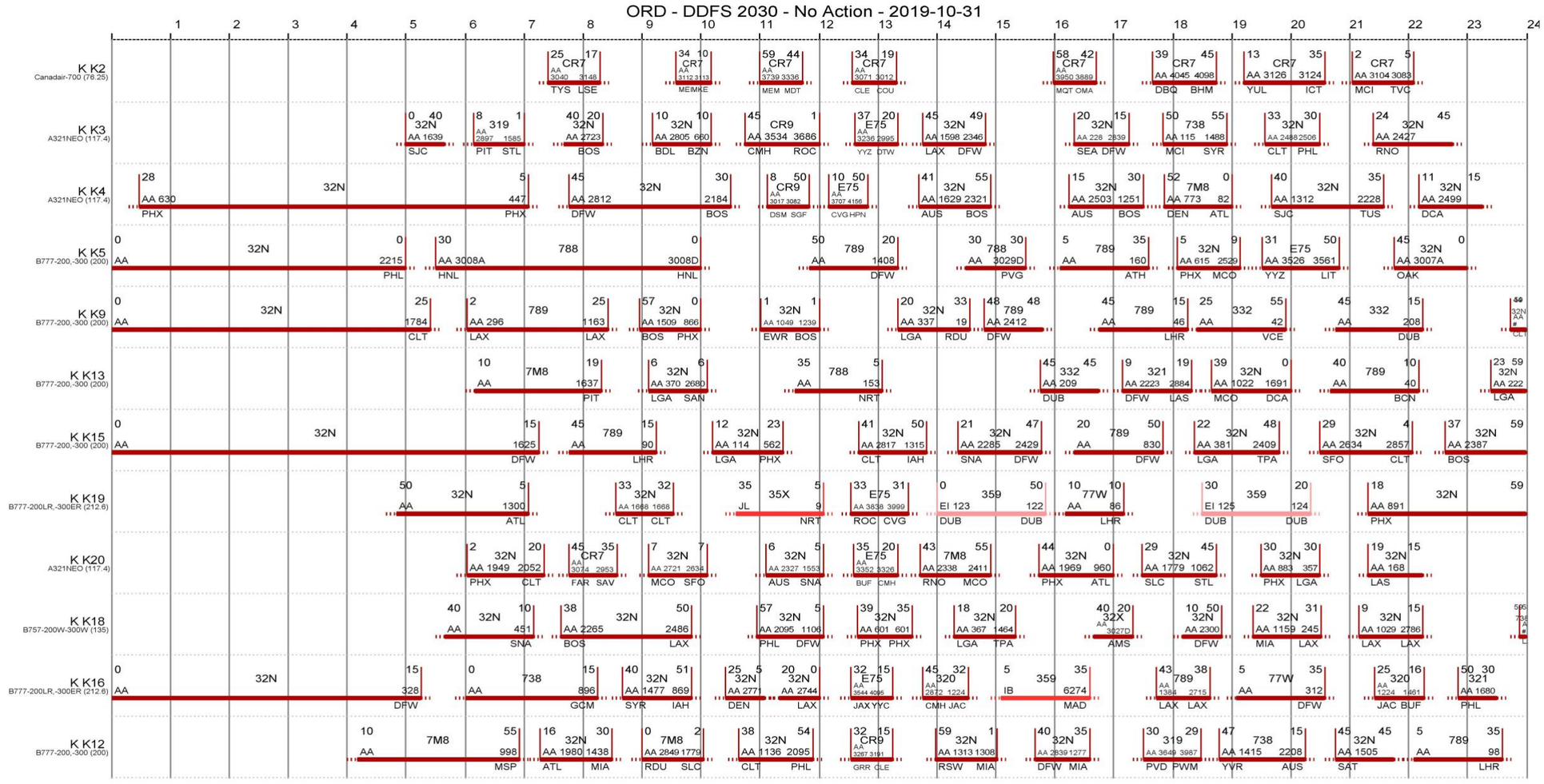

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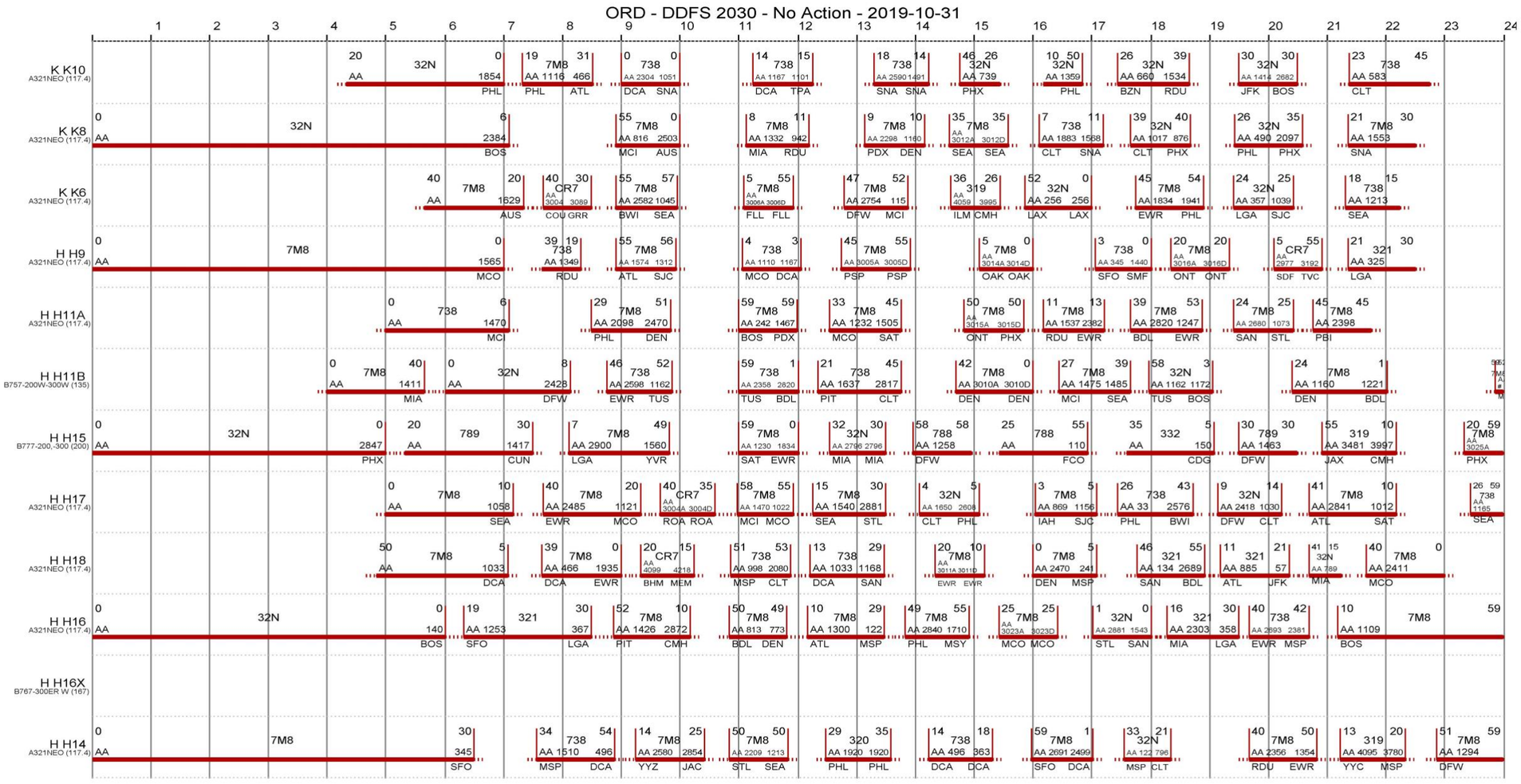

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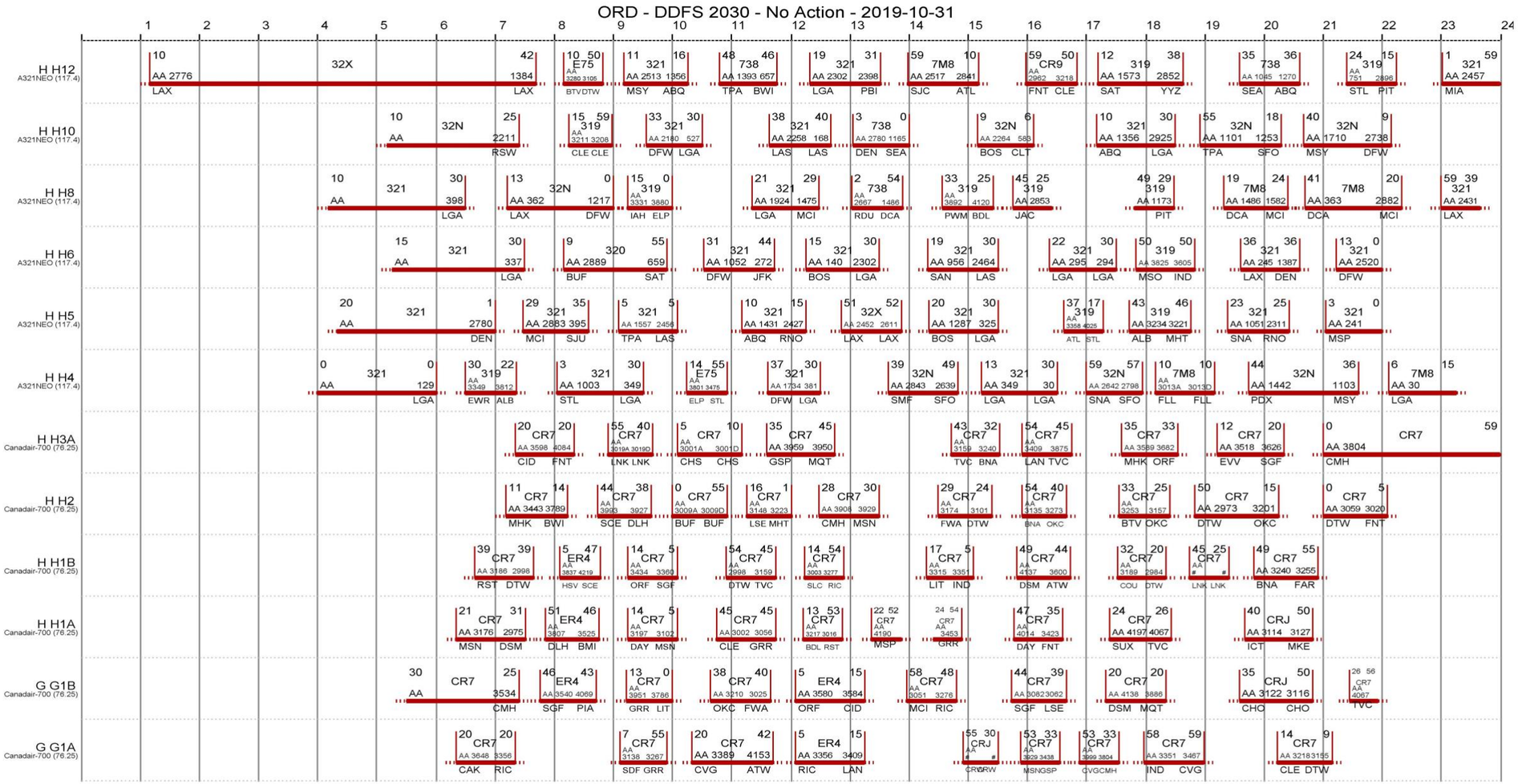

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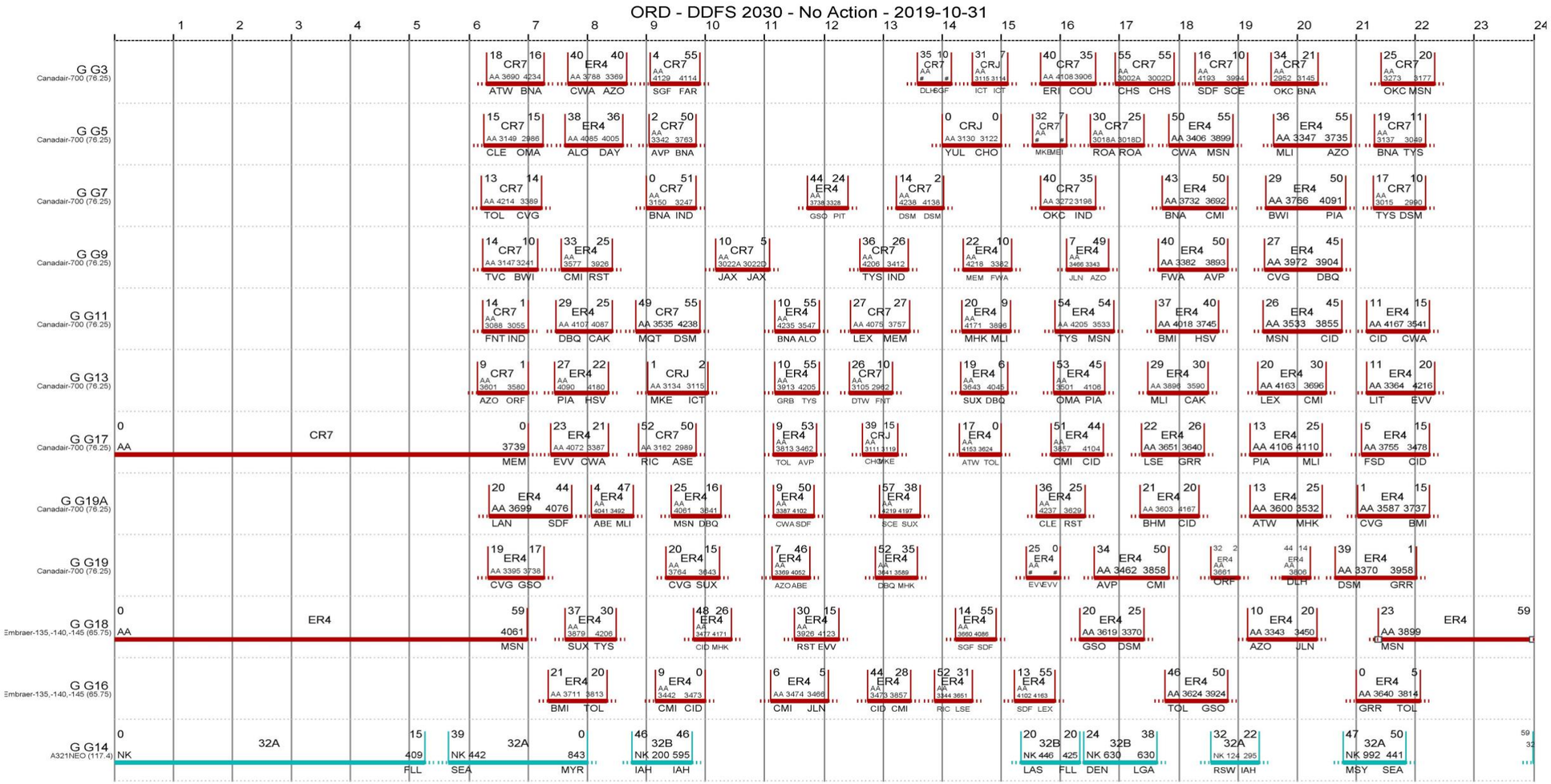


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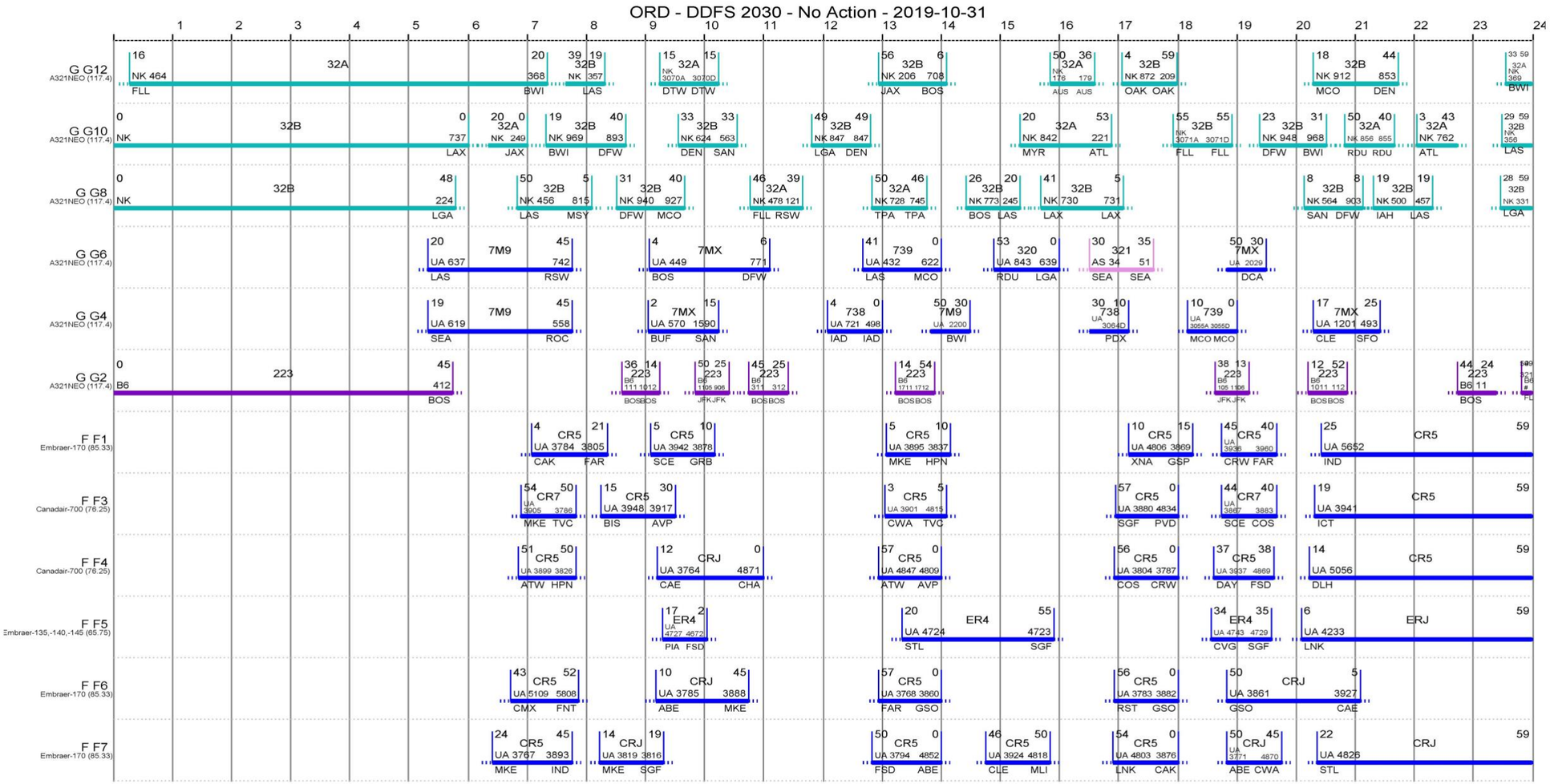

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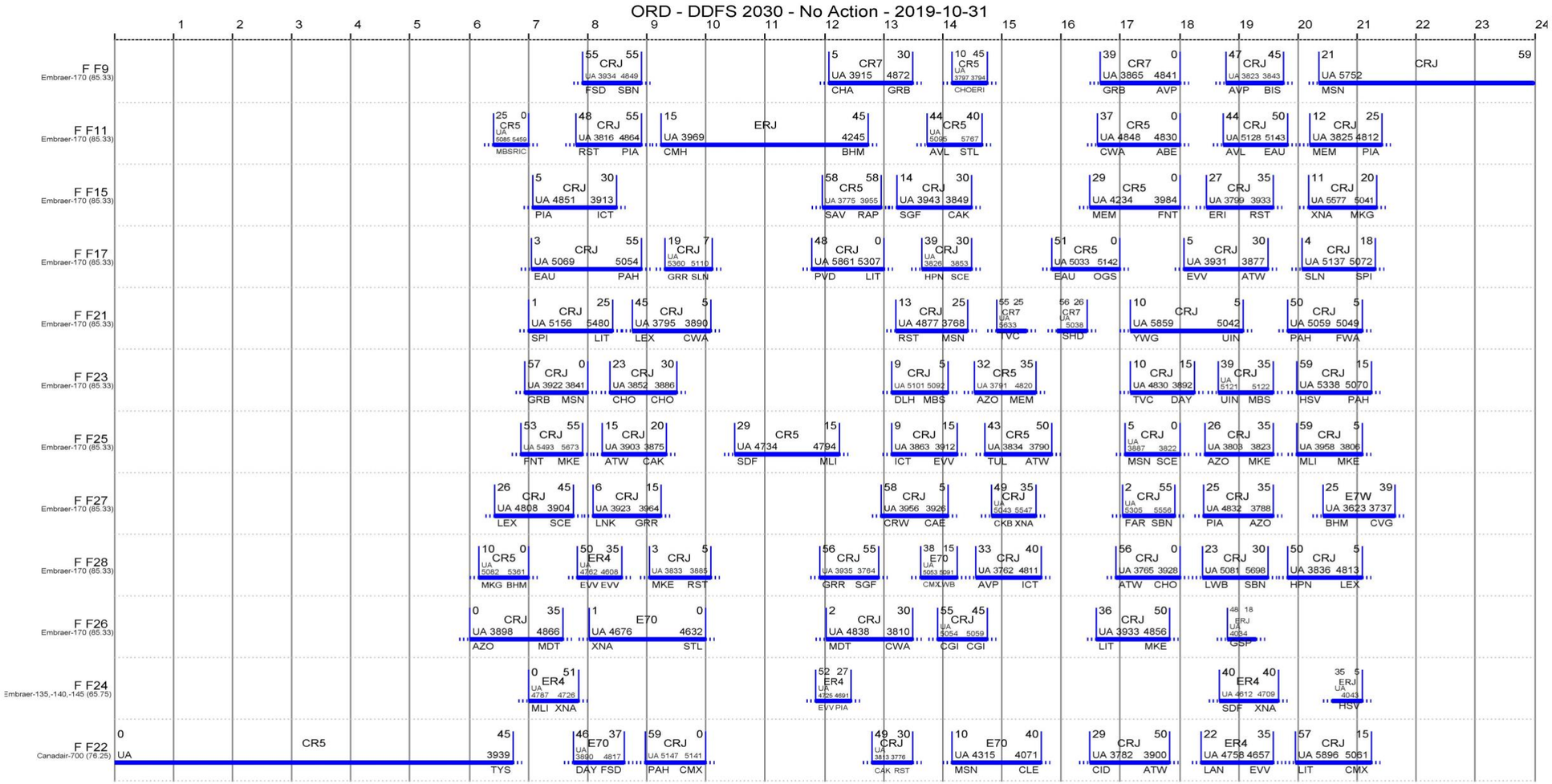


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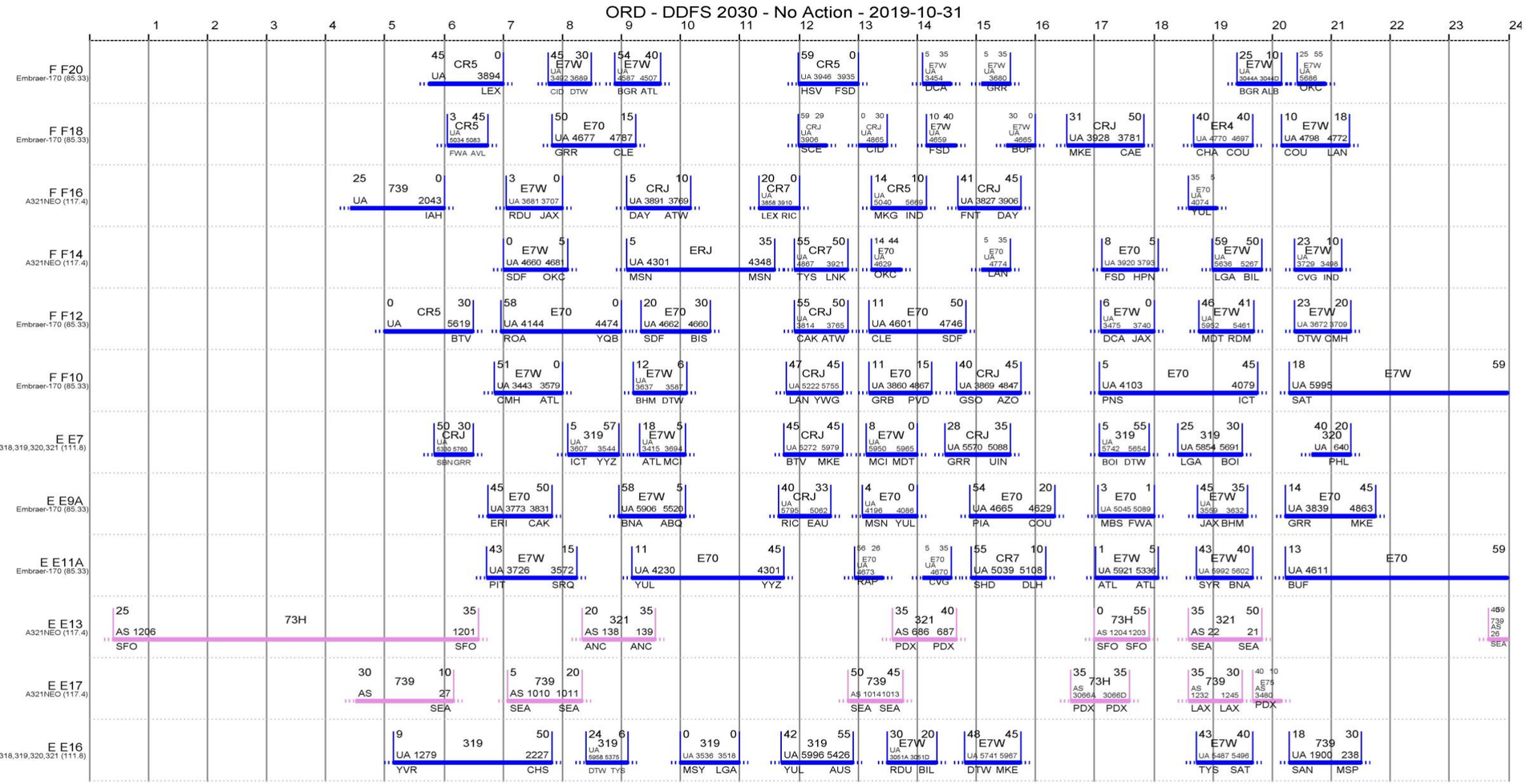

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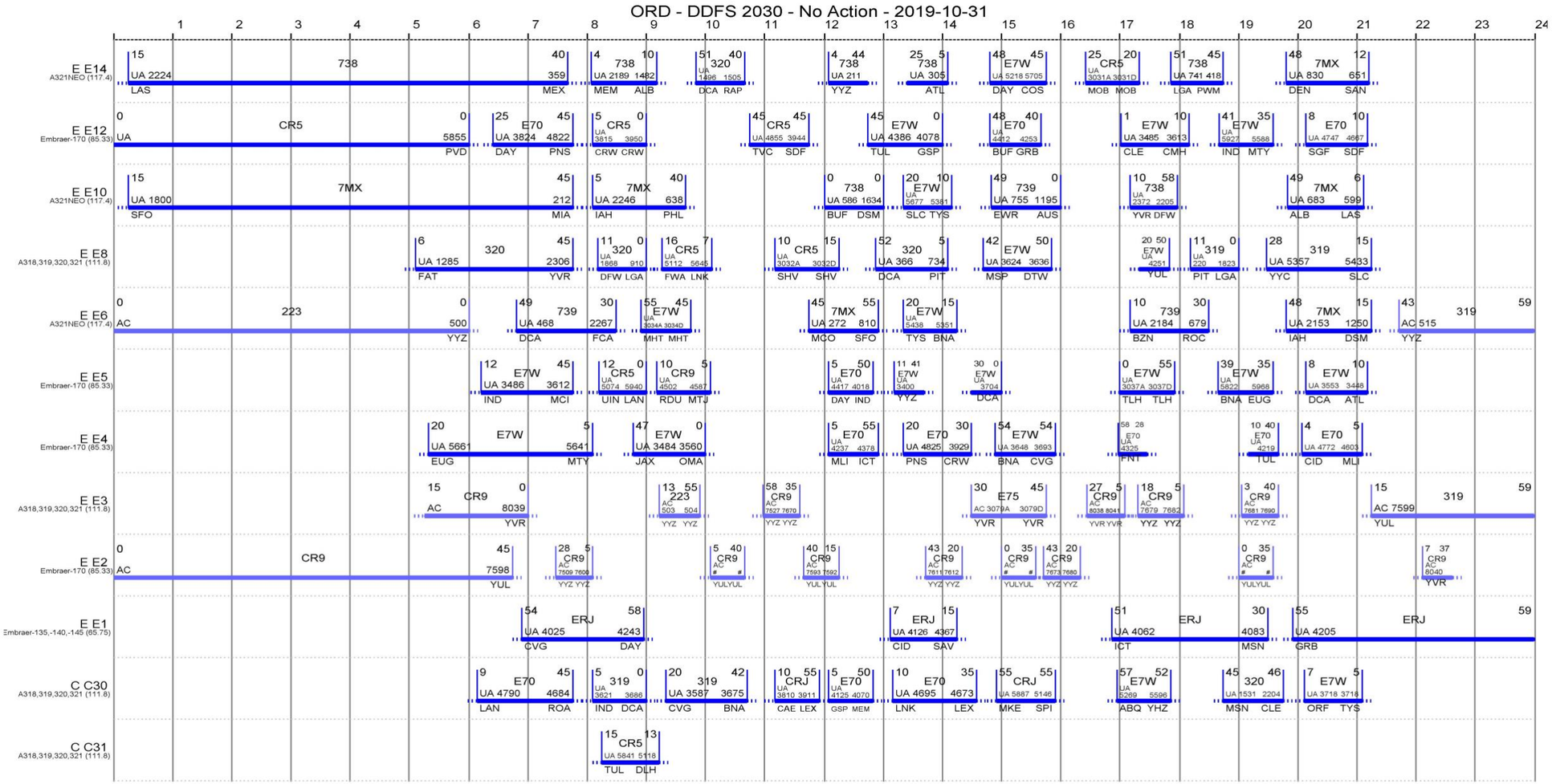


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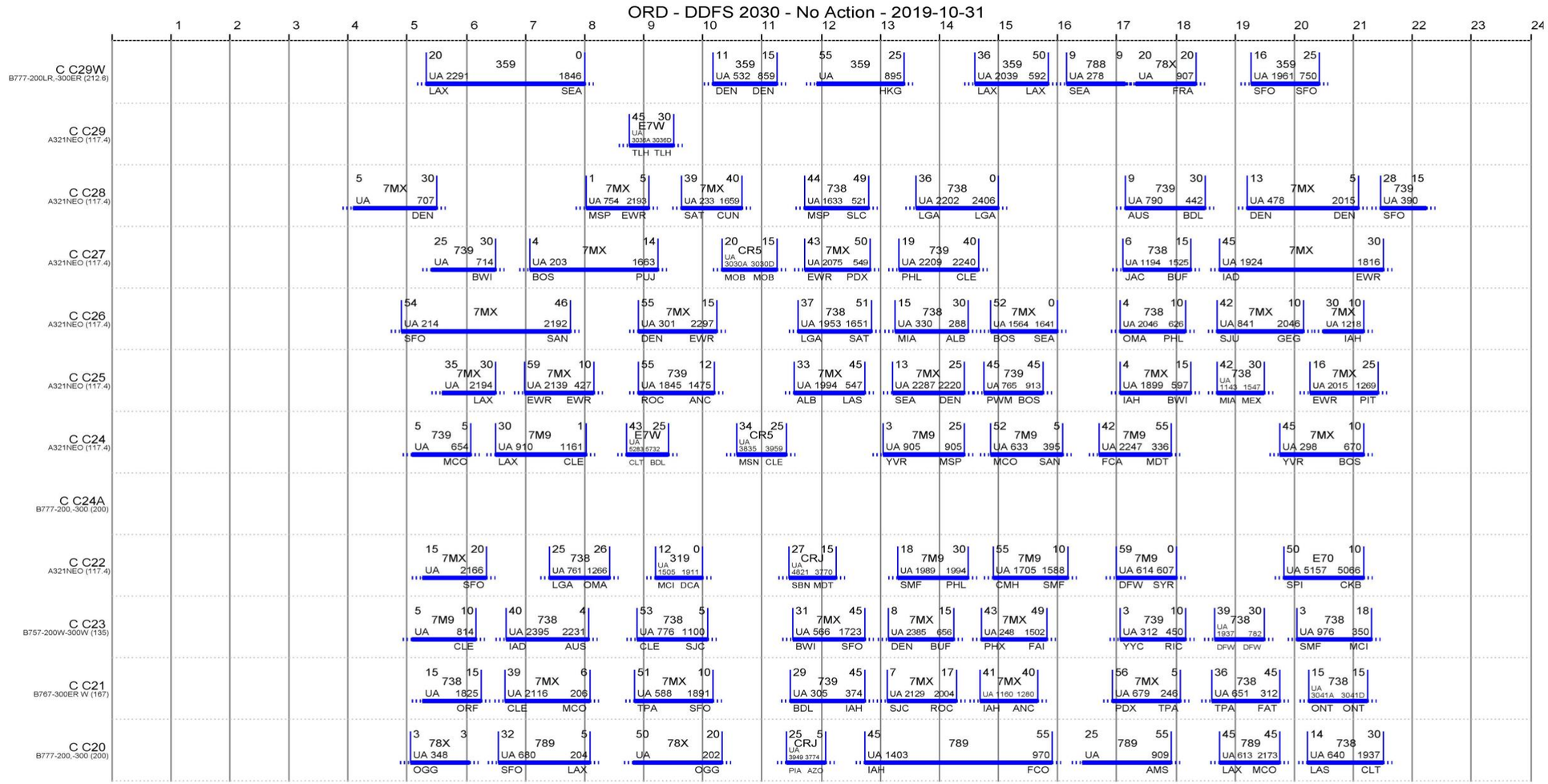

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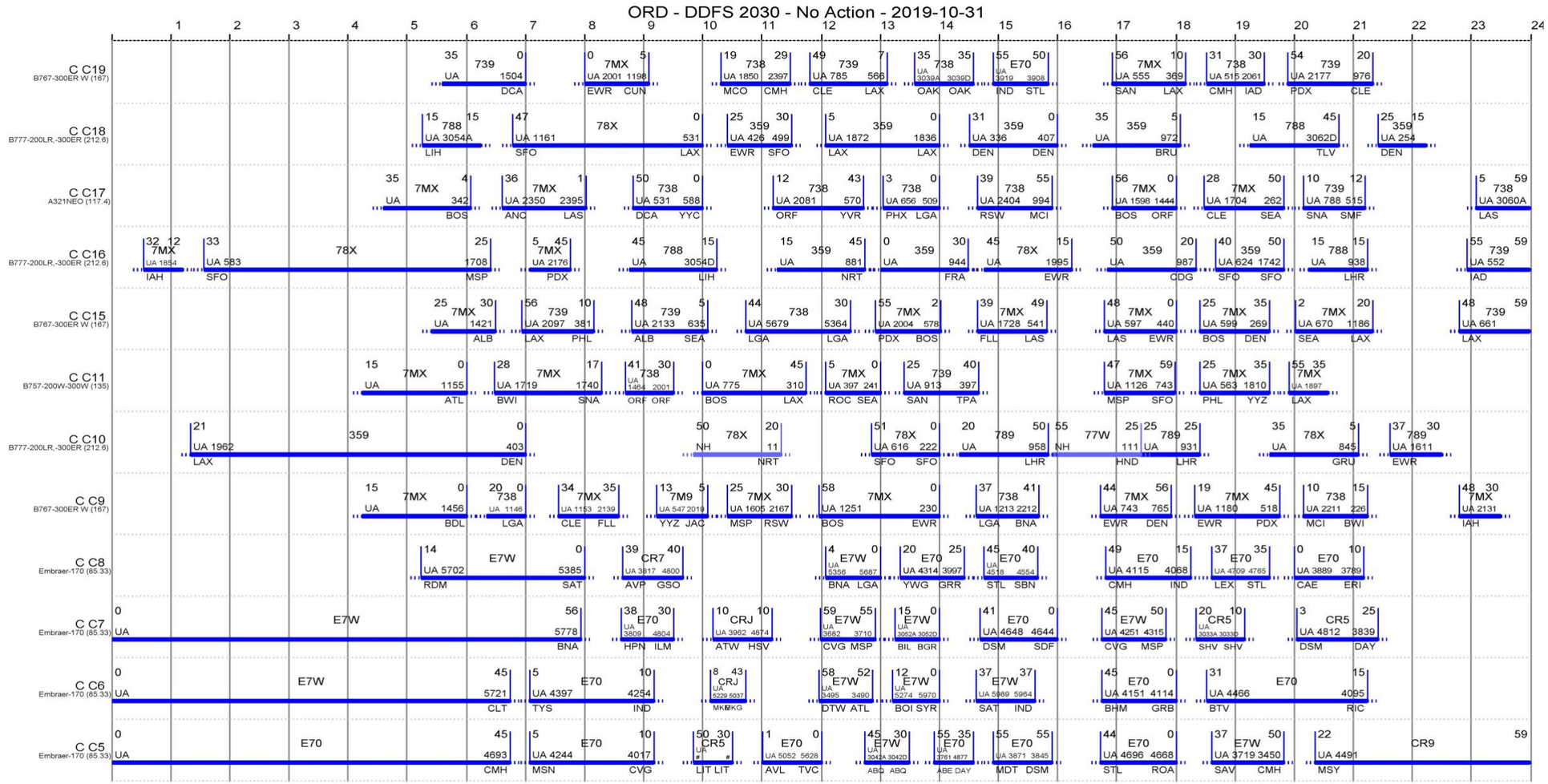


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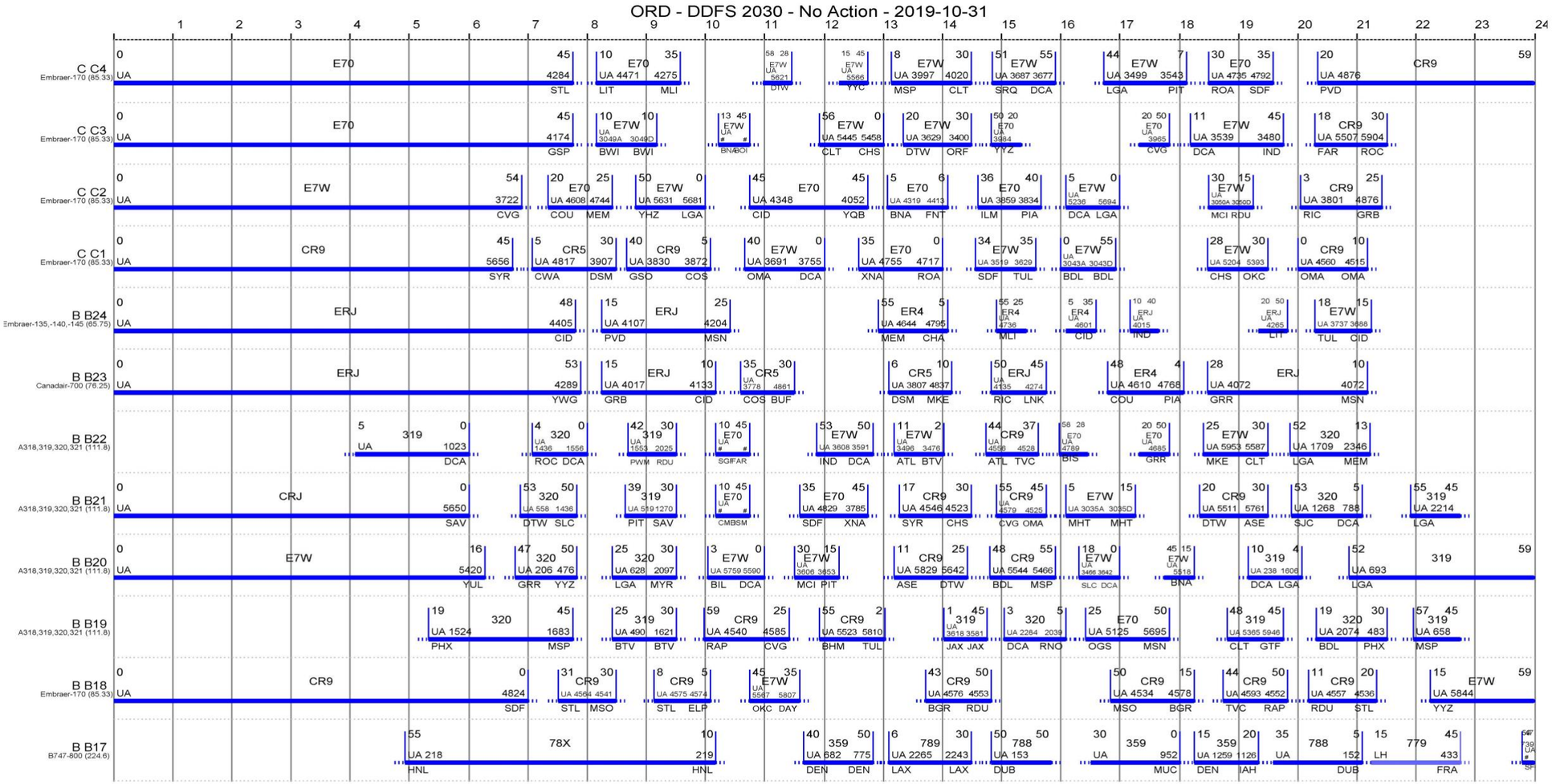

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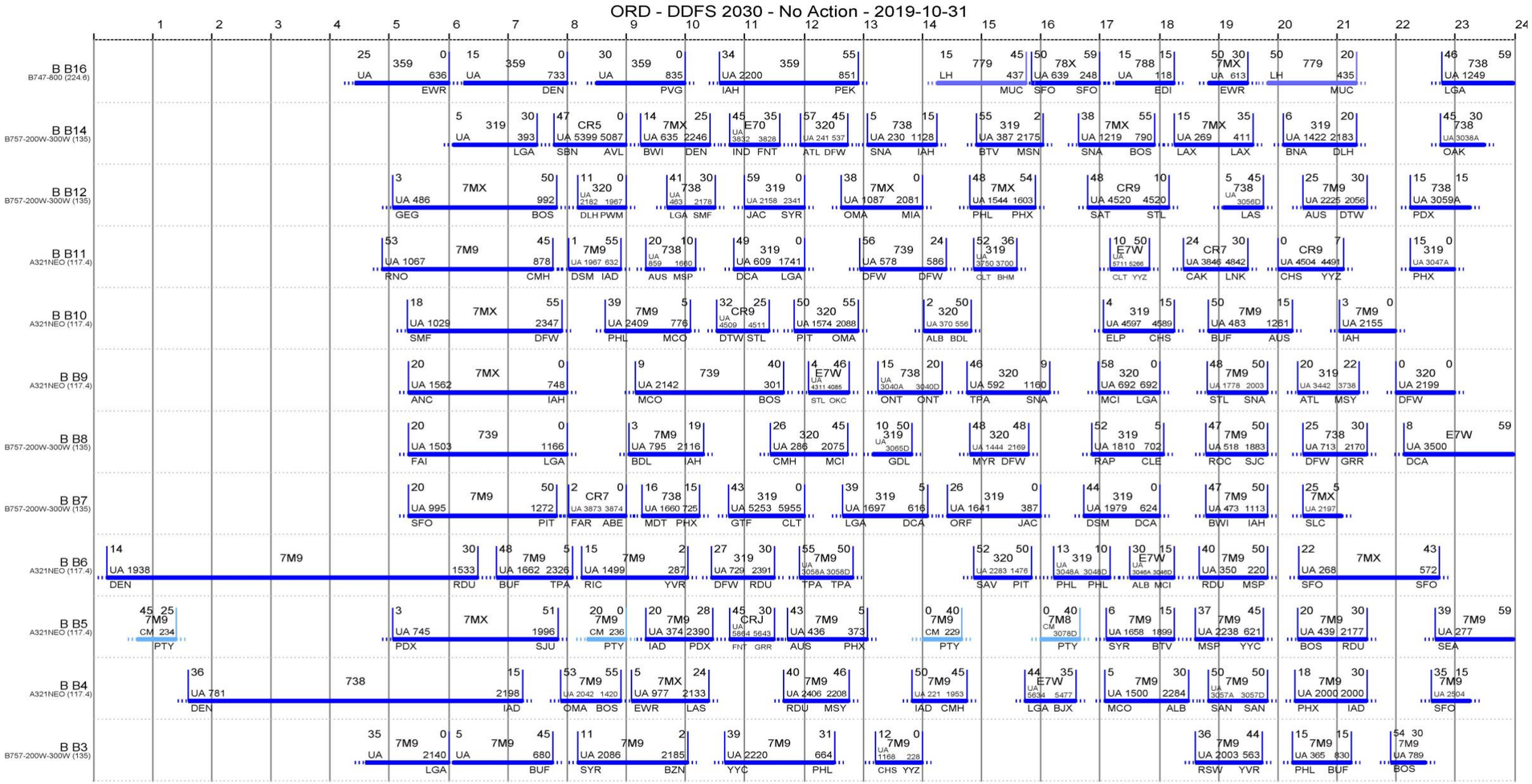

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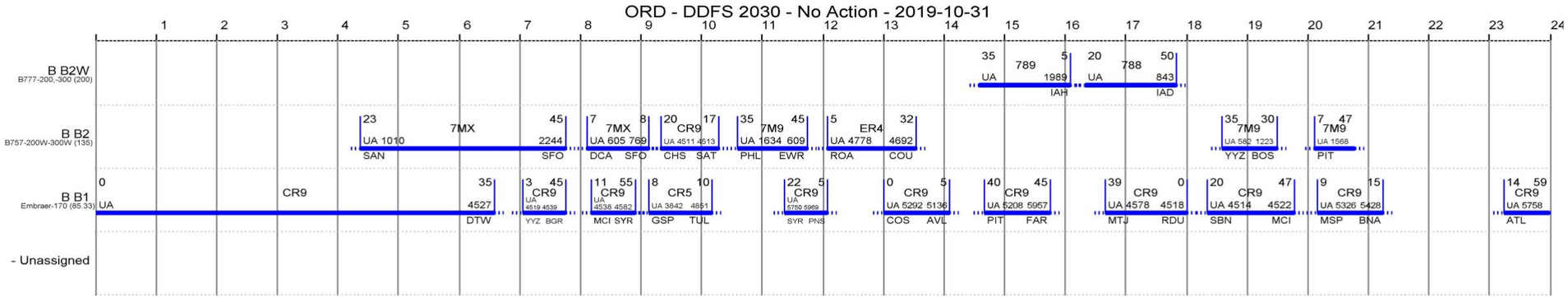


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